
UNIT 1 BASIC PROCESS/CONCEPT IN RESEARCH

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1.0 INTRODUCTION

Let us start our journey into the realm of human mind. A scientific quest for understanding will be the foremost in our journey. We want to know why we think, feel and behave as we do. What makes each of us different from all other people? Why we do often behave as alike in some situations. Psychologists, as scientists, answer these questions systematically, develop the principles to explain them and use those principles to solve various problems. They are actively engaged in process of doing research.

Research is a process through which new knowledge is discovered. A theory, such as a theory of motivation, or development, or learning, for example, helps

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us to organise this new information into a coherent body, a set of related ideas that explain events that have occurred and predict events that may happen. Conducting research requires to follow a sequence of steps. The exact sequence and steps vary somewhat with the type of research. The steps vary slightly by whether a study involves a quantitative or a qualitative approach and data.

This unit attempts to acquaint you with the nature and relevance of research. This is followed by the qualities of a good research. Further, you will find the process of psychological research within the context of discovery (getting and idea) and context of justification (Testing hypothesis). This unit will provide a quick glance at the whole process of research to acquaint you with the various tasks you faced to undertake to carry out your research. It will give your some idea of what the research journey involved. Finally, this unit will cover the total spectrum of research and endeavor starting from the problem through to writing a research report and its publication.

1.1 OBJECTIVES

After reading this unit, you will be able to:

- Define research;
- Describe the meaning of research;
- Explain the relevance of research;
- Describe the process of conducting research;
- Elucidate how to evaluate a research;
- Analyse how to maintain objectivity and minimize bias in psychological research;
- Explain the role of theory, hypothesis and paradigm in psychological research;
- Enlist the various steps needed for conducting a research;
- Explain how theoretical knowledge can be further applied to undertake a research; and
- Analyse the importance of each steps involved in research process.

1.2 DEFINITION AND MEANING OF RESEARCH

The word research is composed of two syllables, *re* and *search*. The dictionary defines the former as a prefix meaning again, a new or over again and the latter as a verb, meaning to examine closely and carefully, to test and try, or to probe. Together they form a noun describing a careful, systematic, patient study and investigation in some field of knowledge, undertaken to establish facts or principles (Grinnell 1993). The simplest meaning of research is to search for facts, answers to research question and solution for the problem.

Scientific Research is a systematic and objective attempt to provide answers to certain questions. The purpose of scientific research is to discover and develop an organised body of knowledge. Therefore, scientific research may be defined as the systematic and empirical analysis and recording of controlled observation,

which may lead to the development of theories, concepts, generalisations and principles, resulting in prediction and control of those activities that may have some cause-effect relationship. Some of the definitions of research in literature are given below which can help you to understand proper meaning and concept of research.

Encyclopaedia of Social Science defines research as, “the manipulation of generalising to extend, connect or verify knowledge...” Manipulation incorporates experimentation adopted for the purpose of arriving at generalisation.

Kerlinger (1973) defines research as a “systematic, controlled, empirical and critical investigation of hypothetical propositions about the presumed relationship about various phenomena.”

Burns (1994) also defines research as ‘a systematic investigation to find answers to a problem’.

Thus, the term research refers to the systematic method consisting of enunciating the problem, formulating a hypothesis, collecting the facts or data, analysing the facts and reaching certain conclusions either in the form of solution (s) towards the concerned problem or in certain generalisations for some theoretical formulation.

1.3 CRITERIA OF GOOD RESEARCH

The criteria for good research are as follows:

Purpose of research should be clearly defined and common concepts that are used should be operationally defined.

The research procedure should be precisely planned, focused and appropriately described in order to enable other researcher to do research for further advancement.

Research design should be carefully planned to generate results to maintained objectivity.

The research report should be as much as possible frank enough to gauge effects of the findings.

Data analysis in the research report should be adequate to reveal its significance and the method of analysis employed be appropriate and

Validity and reliability of data should be examined carefully.

1.4 OBJECTIVES OF GOOD RESEARCH

The purpose of research is to discover answers to questions through the application of scientific procedures. The main aim of research is to find out the truth which is hidden and which has not been discovered as yet. Though each research study has its own specific purpose, we may think of research objectives as falling into a number of following broad groupings:

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- 1) To gain familiarity with a phenomenon or to achieve new insights into it (studies with this object in view are termed as exploratory research studies);
- 2) To portray accurately the characteristics of a particular individual, situation or group (studies with this object in view are known as descriptive research studies);
- 3) To determine the frequency with which something occurs or with which it is associated with something else (studies with this object in view are known as diagnostic research studies)'
- 4) To test a hypothesis of a causal relationship between variables (such studies are known as hypothesis- testing research studies/experimental studies).

Thus, research is the fountain of knowledge for the sake of knowledge and an important source of providing guidelines for solving different business, personal, profession governmental and social problems. It is a sort of formal training which enables one to understand the new developments in one's field in a better way.

1.5 QUALITIES OF A GOOD RESEARCH

Good research possesses certain qualities which are as follows:

Good research is systematic: it means that research is structured according to set of rules to follow certain steps in specified sequence. Systematic research also invites creative thinking, and certainly avoids use of guessing and intuition for arriving at the conclusion.

Good research is empirical: it implies that any conclusion drawn is based upon hardcore evidence gathered from information collected from real life experiences and observations. This provides a basis for external ability to research results.

Good research is valid and verifiable: Research involves precise observation and accurate description. The researcher selects reliable and valid instruments to be used in the collection of data and uses some statistical measures for accurate description of the results obtained. Whatever you conclude on the basis of finding is correct and can be verified by yourself and others.

Good Research is logical: it suggests that research is guided by the rules of reasoning and logical process of induction (general to specific) and deduction (specific to general) that plays an important role in carrying out research. In fact, logical reasoning makes research feasible and more meaningful in the context of decision making.

Good research develops theories and principles: which are very helpful in accurate prediction regarding the variables under study. On the basis of the sample observed and studied, the researcher makes sound generalisations regarding the whole populations. Thus, research goes beyond immediate situations, objects or groups being investigated by formulating a generalisation or theory about these factors.

Research is replicable: the designs, procedures and results of scientific research should be replicable so that any person other than the researcher himself may assess their validity. Thus, one researcher may use or transit the results obtained by another researcher. Thus, the procedures and results of the research are replicable as well as transmittable.

1.6 RESEARCH PROCESS: BASIC CONSIDERATIONS

Before we examine what researchers have found in the major areas of psychology, we need to identify the ways psychologists gather data about behaviour and mental processes. Recall that psychology is the scientific study of behaviour and mental functioning of individuals. It is scientific because it uses the principles and practices of the scientific method.

Let us turn now how psychologists know *what* they know.

Empirical investigation in any field requires the use of the scientific method to observe, measure, and experiment. Even if you never do any scientific research in your life, mastering information on psychological research will be useful. You can improve your critical thinking skills by learning how to ask the right questions about behaviour and how to evaluate the answers you find.

Psychological research process can be divided into two major categories that usually occur in sequence that is (i) getting an idea [context of discovery] and then (ii) testing it (context of justification).

1.6.1 Context of Discovery

This is the initial phase of research during which observations, belief, information, and general knowledge etc., lead someone to come up with a new idea or a different way of thinking about phenomena.

1.6.1.1 Role of Theories, Hypotheses and Paradigms in Psychological Researches

Researchers begin with the assumption of determinism, the idea that all events (physical, mental and behavioural) result from specific causal factors. Researchers also assume that behaviour and mental processes follow set patterns of relationships that can be discovered and revealed through research.

Psychological theories, in general, attempt to understand how brain, mind, behaviour, and environment function and how they may be related. Any particular theory focuses on a more specific aspect of this broad conception, using a body of interrelated principles to explain or predict some psychological phenomenon.

The value of a theory is often measured in terms of the new ideas, or hypotheses, that can be derived from it and tested. A hypothesis is a tentative and testable explanation of the relationship between two or more events or variables. A **variable** is any factor that changes, or varies, in size or quality. To illustrate this mood may be a variable, since people's moods may vary from one situation to another. Test performance is another variable, since a person's score may vary from one test to the next.

Finally, our understanding of a complex process is also aided by using the correct paradigm. A *paradigm* is a model of the functions and interrelationships of a process, a "way of thinking" about the world and how to study it. Entire field of knowledge, including psychology, can change directions when new paradigm challenges existing ones. When paradigms shift, revolutions of knowledge usually

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follow (Kuhn, 1970). Before a new theory, hypothesis, or paradigm makes a difference in science, it has to undergo an “ordeal of proof.” Most often this happens when researchers publish (i.e. make public) their findings, and other scholars investigate whether they find the same patterns in their own data. This process of publication and communication moves scientific research into the public eye, where ideas are tested and proven.

1.6.1.2 Research Biases

One of the challenges, while doing research is to remain objective and free from biases. Most of your ideas and beliefs are probably linked with certain bias because they are influenced by your opinions or values. A variety of biases have been found to distort people’s impressions of collected data. *External influences* such as one’s culture or the media can influence people to accept a particular world view. *Personal bias* distorts estimating or evaluating processes as a result of personal beliefs, attributes, or past experiences. *Observer bias* operates when some events are taken as meaningful by some and not taken meaningful by others. It must be kept in mind that researchers themselves were raised in certain cultures and societies. They also might have been exposed to certain gender role expectations. These background factors can all affect the way that researchers observe and interpret events in their lives. *Expectancy bias* can affect observations of behaviour by encouraging reactions to the events being observed. Researchers sometimes expect to find specific outcomes, they may see what they expect to see rather than remain objective. Unfortunately, if one is not alert to the possibility of expectancy bias, it may seem as though the observed events are being “discovered” instead of created by the observer’s expectations.

Finally, *placebo biases* operate when people strongly want to believe a treatment is successful. For example, many people may claim to feel better after taking a placebo such as a sugar pill. In those cases where the outcome involves a subjective judgment about results, that is, how well a person feels well or whether the pain has been reduced or relieved, the desire for a drug or therapeutic method to work may be enough to achieve the desired result.

1.6.2 Context of Justification

The context of justification is the second phase of research in which results are prepared for useful communication with other scientists. Psychologists face a difficult challenge when they try to get accurate data and reliable evidence that will generate valid conclusions. They rely on one ally to succeed: the scientific method. Scientific method is a general set of procedures for gathering and interpreting evidence in ways that limit errors and yield dependable conclusions. The scientific method also demands special attitudes and values on the part of research scientists.

1.6.2.1 Scientific Attitudes and Values Associated with Research Process

Scientists are motivated by a curiosity about the unknown and the uncertain. Since the truth may be disguised, the scientific method demands a critical and skeptical attitude toward any conclusion until it has been duplicated repeatedly by independent investigations. Secrecy is banned from the research procedure because all data and methods must eventually be open for public verifiability and domain. Other researchers must have the opportunity to review the data and

conclusions and then attempt to replicate the results. Thus, science is not a set of rules but rather a process of asking, observing, explaining, testing, and retesting explanations of reality.

1.6.2.2 Objectivity Safeguards in Research Process

This consists of (i) procedural safeguards (ii) standardisation (iii) operationalisation (iv) avoiding of bias. Let us take each of these and discuss.

Since subjectivity must be minimized in the data collection and analysis phases of scientific research, **procedural safeguards** are used to increase objectivity. These safeguards begin with keeping complete records of observations and data analyses in a form that other researchers can understand and evaluate. As a result, most scientific reports are written in a similar form and published by organisations of scientists. These reports communicate ideas to the entire scientific community and open those ideas to criticism. A second safeguard is standardisation. **Standardisation** means using uniform, consistent procedures in all phases of data collection. All subjects should receive the same instructions and be treated in the same way. By applying a standard treatment for all participants in the course of study, researchers ensure they will have the same basic experience. A third safeguard involves standardising the meaning of concepts, known as **operationalisation**. An operational definition of a concept defines that concept in terms of how it is measured or what operations produce it. Researchers must also safeguard objectivity by avoiding bias. As explained earlier, bias from external influences, personal beliefs, observers' perspectives, and human expectations can all distort data. Researchers use various control procedures to avoid such biases and test hypotheses in ways that are fair and error-free.

Self Assessment Questions

- 1) An investigator comes up with a new idea or a different way of thinking is known as context of discovery (True/False)
- 2) Use of uniform consistent procedure in all faces of data collection is known as standardisation. (True/False)
- 3) Scientific knowledge is not based on empirical evidences. (True/False)
- 4) Psychologists should not maintain objectivity by avoiding biases. (True/False)
- 5) Psychological researches should be replicable (True/False)
- 6) Operational definition of a concept is not necessary in scientific research. (True/False)

Answers: (1) T, (2) T, (3) F, (4) F, (5) T, (6) F

1.7 STEPS IN RESEARCH PROCESS

Research process consists of series of actions and steps needed for conducting scientific research, if the researcher follows certain steps in conducting the research, the work can be carried out smoothly with least difficulty. These steps are described as beneath—

1.7.1 Step-I: Identification of the Problem

The first and most important step for identifying a problem is asking a question or identifying a need that arises as a result of curiosity and to which it becomes necessary to find an answer. The psychological studies are focused on one or many of the following kinds of questions:

What are the events that cause or determine a given behaviour or response?

What is the nature of behaviour or action (i.e., its structure) and how it is linked with other actions and behaviours?

What are the relationships of internal psychological processes with behavioural phenomenon?

The research question determines the direction of study and researchers have to struggle a lot in identifying and articulating the same. Essentially two steps are involved in formulating the research problem, viz, understanding the problem thoroughly, and rephrasing the same into meaningful terms. The main function of formulating a research problem is to decide what you want to find out about.

It is extremely important to evaluate the research problem in the light of funds, time and expertise and knowledge available at your disposal. It is equally important to identify any gaps in your knowledge of relevant disciplines, such as statistics required for analysis.

Once the question has been asked, that next step is to identify the factors that have to be examined to answer the question. Such factors might range from the most simple, such as a child's age or socioeconomic status, to more complicated measures such as the effects of violent cartoons on a child's behaviour. The factors may be age of the child, degree of violence in programs, emotional arousal, facial expression, family communication patterns etc. Besides this, following factors should be considered by the researcher for identifying in research problem:

Have not been investigated before;

Will contribute to the understanding of your question;

Are available to investigate;

Lead to another question!

For identifying a good solvable problem, the investigator undertakes the **review of literature**. A body of prior work related to a research problem is referred to as literature. Scientific research includes a review of the relevant literature. When a researcher reviews the previous researches in related fields, he becomes familiar with several known and unknowns. Therefore one obvious advantage of review of the literature is that it helps to eliminate duplication of what has already been done and provide guidance and suggestions for further research. The main purpose of review of the literature is fourfold. First it gives an idea about the variables which have been found to be conceptually and practically important and unimportant in the related field. Thus the review of literature helps in discovering and selecting variables relevant for the given study. Second the review of the literature provides an estimate of the previous work and provides an opportunity for the meaningful extension of the previous work.

Third, a review of the literature helps the researcher in systemising the expanding and growing body of knowledge. This facilitates in drawing useful conclusions

regarding the variables under study and provides a meaningful way of their subsequent applications. Fourth, a review of the literature also helps in redefining the variables and determining the meanings and relationships among them so that the researcher can build up a case as well as a context for further investigation that has merit and applicability. There are different sources of review of the literature such as journals, books, abstracts, indexes and periodicals. If you are not sure what journals and other resources to examine for research idea, you should know that the computer search engine **PsycINFO** is a very effective tool for going through the technical literature. The print companion to PsycINFO is psychological abstracts and both of these contain abstracts of articles from almost all journals that publish psychological research. If you find an abstract of interest, you can then read the entire articles for additional information.

1.7.2 Step-II: Formulating a Hypothesis

When the researcher has identified the problem and reviewed the relevant literature he formulates a hypothesis which is a kind of suggested answer to the problem. Hypothesis plays the key role in formulating and guiding any study. The hypotheses are generally derived from earlier research findings, existing theories, and personal observations and experiences. From a careful examination of relevant theory and previous findings, the psychologist would be able to state one or more propositions whose validity could be tested. Ideally these hypotheses would be based on a deductive theory but they may simply be new hypotheses or hypothesis based on previous research findings. Hypothesis may be defined as a tentative statement showing a relationship between variables under study. It is stated in the form of a declarative sentence. For instance, suppose you are interested to know the effect of reward on learning. You have analysed the past research and found the indication that the two variables are positively related. You need to convert this idea in terms of a testable statement. At this point you may develop the following hypothesis. *Those who are rewarded shall require lesser number of trials to learn the lesson than those who are not rewarded.* For unbiased research the researcher must formulate a hypothesis in advance of the data – gathering process. No hypothesis should be formulated after the data are collected.

1.7.3 Step-III: Identifying, Manipulating and Controlling Variables

While talking about the hypothesis you will encounter this word i.e. variable in the scientific literature in the psychology. Variables are defined as those characteristics which are manipulated, controlled and observed by the experimenter. At least three types of variables must be recognised at the outset – the dependent variable, the independent variable and the extraneous variable. The dependent variable is one about which the prediction is made on the basis of the experiment. In other words the dependent variable is the characteristics or condition that changes as the experimenter changes the independent variables. The independent variable is that condition or characteristics which is manipulated or selected by the experimenter in order to find out its relationship to some observed phenomena. An extraneous variable is the uncontrolled variable that may affect the dependent variable. The experimenter is not interested in the changes produced due to the extraneous variable and hence, he tries to control it as far as practicable. The extraneous variable is known as the relevant variable. In order to make a variable clear, precise and easy to communicate it is important

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that it is operationally defined. An operational definition involves specifying the actual operations that define a given variable. Operational definition is also important for the purpose of measurement. Since psychological variables are complex and their measurement poses special problems. Therefore, psychologists are very eager to use operational definitions. They frequently use verbal measures, behavioural measures and psychological measures of variables in their studies, which are able to help him or her to specify the operations and may allow quantification.

1.7.4 Step-IV: Formulating a Research Design

A research design may be regarded as the blueprint of those procedures which are adapted by the researcher for testing the relationship between the dependent variable and the independent variable. There are several kinds of experimental designs and the selection of any one is based upon the purpose of the research, types of variables to be controlled and manipulated as well as upon the conditions under which the experiment is to be conducted. The main purpose of experimental design is to help the researcher in manipulating the independent variables freely and to provide maximum control of the extraneous variables so that it may be said with all certainty that the experimental change is due to only the manipulation of the experimental variable. The main function of a research design is to explain how you will find answers to your research questions. The research design sets out the logic of your inquiry. A research design should include the following; logistical arrangements have to be made according to proposed research design, the measurement procedures, the sampling strategy, the frame of analysis and the time frame. For any investigation, the selection of an appropriate research design is crucial in enabling you to arrive at valid findings, comparisons and conclusions. A faulty design may derive misleading findings. Empirical investigation is primarily evaluated in the light of the research design adopted. While selecting a research design it is important to ensure it is valid, workable and manageable.

1.7.4.1 Constructing Devices for Observation and Measurement

When the research design has been formulated, the next step is to construct or choose appropriate tools of research for scientific observation and measurement. Questionnaire and interview schedule are the most common tools which have been developed for the psychological research. If the readymade tools are not available then the researcher may have to develop appropriate tools before undertaking the study. All these tools of research are ways through which data are collected by asking for information from a person rather than observing them.

1.7.4.2 Sample Selection and Data Collection

After deciding the tools for the study the researcher also decides about the participants of the study. Usually a small sample is drawn which represents the population. The participants could be children, adolescents, college students, teachers, managers, clinical patients or any group of the individual in whom/where the phenomenon under investigation is prevalent. Depending on the nature of the research problem a researcher may choose a particular method (e.g. observation, experiment, case study, and survey) for data collection. The researcher also decides how the tools are to be administered to collect data that is individual or group.

In data collection phase, researcher must consider recruitment of staff and assignment to them, way of increasing response rate and cost of training of staff etc. Effect of each of these must be evaluated in terms of cost, accuracy, reliability and validity.

1.7.5 Step-V: Data Analysis and their Interpretation

After making observation the data collected are analysed with the help of various quantitative / statistical and qualitative techniques. Careful scrutiny of the data is a critical aspect of scientific method. The purpose of the analysis is to make sense of the data and see what light they throw on the problem and the hypotheses of the study and draws conclusion accordingly. Data analysis can be done by using univariate analysis in which research deals with a single characteristics of interest, bivariate analysis in which researcher deals with two characteristics of interest and by using multivariate analysis in which more than two characteristics are involves.

Depending upon the nature of data and purpose of the experiment, either a parametric statistic or a non-parametric statistic is chosen for statistical analysis. In general, the purpose of carrying out the statistical analysis is to reject the null hypothesis so that the alternative hypothesis may be accepted.

1.7.6 Step-VI: Drawing Conclusions

The investigator, after analysing the results, draws some conclusions. In fact the investigator wants to make some statement about the research about the research problem which he could not make without conducting his research. Whatever conclusion drawn, researcher generalises it to the whole population. During this phase, hypotheses are accepted or rejected. At the same time the conclusions of the study are related to the theory or research findings from which the hypotheses originally came. Depending on the new findings the original theory may have to be modified.

1.7.7 Step-VII: Preparation of Report and Publication

This is the last step in most of the research studies. The researcher documents all the steps of his or her research in clear terms this report inform that what you have done, what you have discovered and what conclusion you have drawn from findings. If you are clear about the whole process you will also be clear about the way you want to write in your report. This helps the reader to understand the study and use it for various purposes. It allows one to replicate the study. The publication of study in scientific journals or books and in public domain makes the work available for wider dissemination.

Self Assessment Questions

- | | |
|---|-----|
| 1) The first step of research process is identifying a problem. | T/F |
| 2) Hypotheses are formed after formulating a research design. | T/F |
| 3) Preparation of report and publications of research study allow the other researchers to replicate the study. | T/F |
| 4) An operational definition of the variables is not necessary for the purpose of measurement. | T/F |
| 5) Selection of particular data collection method depends on the nature of study. | T/F |

Answers: (1) T, (2) F, (3) T, (4) F, (5) T

1.8 IMPORTANCE OF RESEARCH IN PSYCHOLOGY

Importance and relevance of psychological research is well recognised almost in every sphere of human life. Notable progress has been reported in the field of organisational behaviour, applied aspects of human being, medical sciences and education, through application of psychological research findings.

Empirical and theoretical researches in psychology are taking place in various fields, such as learning, motivation, perception, concept learning and memory and so on. In the quest of psychological facts, laws and theories, psychologists have found research studies very helpful in gauging human and animal behaviour.

Practical gains of psychological research are many, yet include discoveries such as improved methods of treating psychologically disordered people, better designs of vehicles to make them easier and safe to use, and new ways of enhancing the performance and happiness of workers.

In psychological researches experimental methods are widely used. Therefore, nature of majority of psychological researches is highly scientific. Psychological researches have successfully led to control and manipulation of the variables associated with widely used generic and comparative methods. Psychologists have developed such effective experimental designs that they have helped to isolate effect of other variables from independent variables.

In psychological researches, rigorous scientific norms and statistical methods are applied in collection, organisation, description and analysis of the data. By turning psychological facts into quantitative form, the nature of most of the psychological researches remains method oriented (scientific).

1.9 LET US SUM UP

Scientific research may be defined as the systematic and empirical analysis and recording of controlled observation, which may lead to the development of theories, concepts, generalisations and principles, resulting in prediction and control of those activities that may have some cause-effect relationship. Qualities of good research are empirical, logical, verifiable, based on theories and principles and replicable. Psychological researches use the scientific method to test the ideas developed within the context of discovery and the context of justification. In the discovery phase of research, observation, belief and information lead to a new way of thinking about a phenomenon. External and internal biases can distort the discovery phase because our conclusions are often subject to personal biases, observer biases, expectancy biases, and placebo biases. Psychologists use scientific theories, testable hypothesis, and creative paradigms to unravel the mysteries of mind and behaviour. In the justification phase, ideas are tested and either disconfirmed or proven. Psychologist must maintain objectivity by keeping complete records, standardise procedures, make operational definitions, minimize biases and control errors. A reliable result is one that can be repeated in similar conditions by independent investigators. This unit has provided an overview of the research process. The steps of research process includes problem identification, formulation of hypothesis, identification manipulation and controlling of the

variable, formulation of research design, constructing devices for observation, sample selection and data collection, data analysis and interpretation, drawing conclusions and preparation of report and publications.

1.10 UNIT END QUESTIONS

- 1) What is research? Discuss qualities of good research.
- 2) In your opinion, what may be various criteria of a good research?
- 3) Discuss importance and relevance of psychological research.
- 4) How can you minimize research biases in psychological research?
- 5) What is the role of discovery of justification in psychological research?
- 6) List the steps involved in research process?
- 7) Explain the importance of research questions in psychological research?
- 8) What is the role of review of literature in research process?
- 9) Why formulates of hypothesis is necessary while conducting it?
- 10) How the steps in the research process do helps a person to get knowledge?

1.11 GLOSSARY

Empirical Investigation	: Research that relies on sensory experience and observation as research data.
Context of Discovery	: Initial phase of research during which an investigator comes up with a new idea or a different way of thinking about phenomena.
Theory	: A body of interrelated principles used to explain or predict some psychological phenomenon.
Hypothesis	: A tentative and testable explanation of the relationship between two or more events or variables.
Paradigm	: A model of the functions and interrelationships of a process; a “way of thinking” about the world and how to study it.
Context of Justification	: Second phase of research, in which results are tested and prepared for useful communication with the scientific community.
Standardisation	: The use of uniform consistent procedures in all phases of data collection.
Operational definition	: Definition of a concept in terms of how the concept is measured or what operations produce it.
Placebo Control	: A control strategy where researchers compare those who received actual treatment with those who received only attention or a “dummy drug.”

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- Variable** : something that can occur with different values and can be measured.
- Independent Variable** : a variable that represents the hypothesised “cause” that is precisely controlled by the experimenter and independent of what the participant does.
- Dependent Variable** : a variable that represents the hypothesised “effect” whose values ultimately depend on the values of independent variable.

1.12 SUGGESTED READINGS AND REFERENCES

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UNIT 2 RELIABILITY AND VALIDITY (EXTERNAL AND INTERNAL)

Structure

- 2.0 Introduction
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- 2.3 Methods of Estimating Reliability
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 - 2.3.1.1 Test Re-tests Reliability
 - 2.3.1.2 Parallel forms Reliability
 - 2.3.2 Internal Consistency Procedures
 - 2.3.2.1 Split Half Reliability
 - 2.3.2.2 Kudar-Richardson Estimate of Reliability
 - 2.3.2.3 Cronbach's Alfa (α)
- 2.4 Comparison of Reliability Estimators
- 2.5 Validity
- 2.6 Types of Validity
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2.0 INTRODUCTION

Most research is designed to draw the conclusion about the cause and effect relationship among the variables. The goal of the research remains to develop a theory that explains the relationship found among variables. This unit mainly concerns about various problems that can threaten the reliability and validity of conclusions drawn by the researcher.

There are two goals of research design;

- 1) Obtain information relevant to the purposes of the study.
- 2) Collect this information with maximal reliability and validity.

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How can a researcher be sure that the data gathering instrument being used will measure what it is supposed to measure and will do this in a consistent manner?

This is a question that can only be answered by examining the definitions for and methods of establishing the validity and reliability of a research instrument.

Reliability and validity are central issues in all measurement. Both concern connecting measures to constructs. Reliability and validity are salient because constructs are often ambiguous, diffused and not directly observable. Perfect reliability and validity are virtually very difficult to achieve. These two very important aspects of research design will be discussed in this unit. All researchers want their measures to be reliable and valid. Both ideas help to establish the truthfulness, credibility, or believability of findings. This unit will be discussed in two parts. First part covers the concept of reliability and the definitions of reliability. This is followed by various methods of establishing reliability of a research instrument of this unit. Second part of this unit discusses the concept of validity in research. You will familiarise with the various types of validity. Finally, some problems that constitute threats to validity are described.

2.1 OBJECTIVES

After reading this unit, you will be able to:

- Define reliability;
- Describe the various methods of calculating reliability;
- Explain how test retest reliability is accessed;
- Differentiate between tests of reliability;
- Define validity;
- Describe various methods of validity;
- Identify the problems that constitute threats to internal external validity; and
- Differentiate between internal and external validity.

2.2 RELIABILITY

Meaning of Reliability

The idea behind reliability is that any significant results must be repeatable. Other researchers must be able to perform exactly the same experiment, under same conditions and generate the same results. This will vindicate the findings and ensure that all researchers will accept the hypothesis. Without this replication of statistically significant results, experiment and research have not fulfilled all of the requirements of testability. This prerequisite is essential to a hypothesis establishing itself as an accepted scientific truth. For example, if you are performing a time critical experiment, you will be using some type of stopwatch. Generally, it is reasonable to assume that the instruments are reliable and will keep true and accurate time. However, scientists take measurements many times, to minimize the chances of malfunction and maintain validity and reliability. At the other extreme, any experiment that uses human judgment is always going to come under question. Human judgment can vary as individual observer may rate

things differently depending upon time of day and current mood. This means that such experiments are more difficult to repeat and are inherently less reliable. Reliability is a necessary ingredient for determining the overall validity of a scientific experiment and enhancing the strength of the results.

Reliability is the consistency of your measurement, or the degree to which an instrument measures the same way each time it is used under the same condition with the same subjects. In short, it is the repeatability of measurement. A measure is considered reliable if a person's score on the same test given twice is similar. It is important to remember that reliability is not measured, it is estimated. For instance, if a test is constructed to measure a particular trait; say, neuroticism, then each time it is administered, it should yield same results. A test is considered reliable if we get same result repeatedly.

According to Anastasi (1957), the reliability of test refers to the consistency of scores obtained by the individual on different occasions or with different sets of equivalent items.

According to Stodola and Stordahl (1972), the reliability of a test can be defined as the correlation between two or more sets of scores of equivalent tests from the same group of individuals.

According to Guilford (1954), reliability is the proportion of the true variance in obtained test scores.

The reliability of test is also defined from another angle. Whenever we measure something, measurement involves some kind of measure. Error of measurement is generally between true scores and the observed score. However, in psychological term, word error does not imply the mistake has been made. In other words, error in psychological testing implies that there is always some inaccuracy in measurement. Hence, goal of psychological measurement remains to find out the magnitude of such error and develop ways to minimize them.

2.3 METHODS OF ESTIMATING RELIABILITY

There are number of ways of estimating reliability of an instrument. Various procedures can be classified into two groups:

External consistency procedures

Internal consistency procedures

2.3.1 External Consistency Procedures

External consistency procedures compare findings from two independent process of data collection with each other as a means of verifying the reliability of the measure. Two methods are as beneath.

2.3.1.1 Test Re-test Reliability

The most frequently used method to find the reliability of a test is by repeating the same test on same sample, on two different time periods. The reliability coefficient in this case would be the correlation between the score obtained by the same person on two administrations of the test.

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Test-Retest reliability is estimated, when same test is administered on same sample. Therefore, it refers to the consistency of a test among two different time periods or different administrations. The assumption behind this approach is that there will be no substantial changes in the measurement of the construct in question, upon administration on separate occasions. The time gap that is given between measures is of critical value, the shorter the time gap, higher the correlation value and vice versa. If the test is reliable, the scores that are attained on first administration should be more or less equal to those obtained on second time also. The relationship between the two administrations should be highly positive.

Limitations of this approach

There are a few limitations which include the following: (i) Memory Effect/ carry over Effect (ii) Practice effect, (iii) Absence. These are being discussed below:

- i) **Memory effect /carry over effect:** One of the common problems with test-retest reliability is that of memory effect. This argument particularly holds true when, the two administrations take place within short span of time, for example, when a memory related experiment including nonsense syllables is conducted whereby, the subjects are asked to remember a list in a serial wise order, and the next experiment is conducted within 15 minutes, most of the times, subject is bound to remember his/her responses, as a result of which there can be prevalence of artificial reliability coefficient since subjects give response from memory instead of the test. Same is the condition when pre-test and post-test for a particular experiment is being conducted.
- ii) **Practice effect:** This happens when repeated tests are being taken for the improvement of test scores, as is typically seen in the case of classical IQ where there is improvement in the scores as we repeat these tests.
- iii) **Absence:** People remaining absent for re-tests.

2.3.1.2 Parallel Forms Reliability

Parallel-Forms Reliability is known by the various names such as Alternate forms reliability, equivalent form reliability and comparable form reliability.

Parallel forms reliability compares two equivalent forms of a test that measure the same attribute. The two forms use different items. However, the rules used to select items of a particular difficulty level are the same. When two forms of the test are available, one can compare performance on one form versus the other. Sometimes the two forms are administered to the same group of people on the same day.

The Pearson product moment correlation coefficient is used as an estimate of the reliability. When both forms of the test are given on the same day, the only sources of variation are random error and the difference between the forms of the test. Sometimes the two forms of the test are given at different times. In these cases, error associated with time sampling is also included in the estimate of reliability.

The method of parallel forms provides one of the most rigorous assessments of reliability commonly in use. Unfortunately the use of parallel forms occurs in practice less often than is desirable. Often test developers find it burdensome to

develop two forms of the same test, and practical constraints make it difficult to retest the same group of individuals. Instead many test developers prefer to base their estimate of reliability on a single form of a test.

In practice, psychologists do not always have two forms of a test. More often they have only one test form and must estimate the reliability for this single group of items. You can assess the different sources of variation within a single test in many ways. One method is to evaluate the internal consistency of the test by dividing it into subcomponents.

2.3.2 Internal Consistency Procedures

The idea behind internal consistency procedures is that items measuring same phenomena should produce similar results. Following internal consistency procedures are commonly used for estimating reliability-

2.3.2.1 Split Half Reliability

In this method, as the name implies, we randomly divide all items that intend to measure same construct into two sets. The complete instrument is administered on sample of people and total scores are calculated for each randomly divided half; the split half reliability is then, simply the correlation between these two scores.

Problem in this approach

A problem with this approach is that when the tests are shorter, they run the risk of losing reliability and it can most safely be used in case of long tests only. It is, hence, more useful in case of long tests as compared to shorter ones. However to rectify the defects of shortness, Spearman- Brown's formula can be employed, enabling correlation as if each part were full length:

$$r = (2r_{hh}) / (1 + r_{hh}) \quad (\text{Where } r_{hh} \text{ is correlation between two halves})$$

2.3.2.2 Kuder-Richardson Estimate of Reliability

The coefficient of internal consistency could also be obtained with the help of Kuder-Richardson formula number 20. One of the techniques for item analysis is item difficulty index. Item difficulty is the proportion or percentage of those answering correctly to an item. For example – symbol 'p' is used to represent the difficulty index. Suppose an item 'X' has $p=0.67$. This means item 'X' was answered correctly by 67% of those who answered the item. To compute reliability with the help of Kuder-Richardson formula number 20, the following formula is used:

$$KR-20 = \frac{N}{N-1} \left(1 - \frac{\sum pq}{\sigma^2} \right)$$

Where

N = the number of items on the test,

σ^2 = the variance of scores on the total test,

p = the proportion of examinees getting each item correct,

q = the proportion of examinees getting each item wrong.

Kuder-Richardson formula 20 is an index of reliability that is relevant to the special case where each test item is scored 0 or 1 (e.g., right or wrong).

2.3.2.3 Cronbach's Alpha (α)

As proposed by Cronbach (1951) and subsequently elaborated by others (Novick & Lewis, 1967; Kaiser & Michael, 1975), coefficient alpha may be thought of as the mean of all possible split-half coefficients, corrected by the Spearman-Brown formula. The formula for coefficient alpha is

$$r_{\alpha} = \left(\frac{N}{N-1} \right) \left(1 - \frac{\sum \sigma_j^2}{\sigma^2} \right)$$

Where r_{α} is coefficient alpha,

N is the no. of items,

σ_j^2 is the variance of one item,

$\sum \sigma_j^2$ is the sum of variances of all items, and

σ^2 is the variance of the total test scores.

As with all reliability estimates, coefficient alpha can vary between 0.00 and 1.00.

Coefficient alpha extends the Kuder-Richard-son method to types of tests with items that are not scored as 0 or 1. For example, coefficient alpha could be used with an attitude scale in which examinees indicate on each item whether they strongly agree, agree, disagree, or strongly disagree.

2.4 COMPARISON OF RELIABILITY ESTIMATORS

All of the reliability estimators listed above have certain pros and cons, like for example: inter-rater is best suited when the measure involves observation, it however requires multiple observers as an alternative one can look at of rating of a single observer repeated on single occasion. It can also be used if the examiner is interested in using a team of raters.

In a situation that involves use of two forms as alternate measure of the same thing, parallel forms estimator is best suited. However, this and the internal consistency measures of reliability have constraints, i.e. one has to have multiple items engineered to measure same construct.

Cronbach's Alpha is useful in case, where lots of items are present. The test-retest reliability is mostly employed in case of experimental and quasi-experimental designs. This also depends upon string of availability of a control group that is measured on two different occasions and until post-test is done, one does not have information about reliability. Accordingly, each one of the above mentioned estimators will give a different value for reliability. Generally, test-retest and inter-rater reliability estimates will be lower in value as compared to parallel forms and internal consistency due to involvement in measurement at different times or with different raters.

Self Assessment Questions

- | | |
|--|-------|
| 1) Internal Consistency Concerns whether the various items on a test are measure the same thing. | T / F |
| 2) Memory effect / carry over effect is possible in parallel form method. | T / F |
| 3) K.R. Formula is applied in which each test item is scored 0 or 1. | T / F |
| 4) Scores from the two halves of a test are correlated with one another in split half reliability. | T / F |
| 5) Spearman Brown formula is used for adjusting split half correlation | T / F |

Answer: 1) T, 2) F, 3) T, 4) T, 5) T

2.5 VALIDITY

As you know that the merit of the psychological test is determine first by its reliability but then ultimately by its validity. Validity refers to the degree to which a test measures, what it claims to measure. It is very necessary for a test to be valid for its proper administration and interpretation.

According to Standard for Educational and Psychological testing (AERA, APA & NCME 1985, 1999); a test is valid to the extent that inferences drawn from it are appropriate, meaningful and useful.

According to Cronbach (1951) validity is the extent to which a test measures what it purports to measure.

According to Freeman (1971) an index of validity shows the degree to which a test measures what it purports to measure when compared with accepted criteria.

According to Anastasi (1988) the validity of a test concerns what the test measures and how well it does so.

The above definitions pointed out that for determining the validity of the test, the test must be compared with some ideal independent measures or criteria. The correlation coefficients computed between the test and an ideal criterion is known as the validity coefficients. Independent criteria refer to some measure of the trait or group of the traits (out side the test) that the test itself claims to measure.

2.6 TYPES OF VALIDITY

There are six types of validity, viz., (i) Content validity (ii) Criterion-related validity (iii) Concurrent validity (iv) Predictive validity (v) Construct validity (vi) Convergent validity (vii) Discriminate validity and (viii) Face validity. These are being discussed below:

2.6.1 Content Validity

According to Mc Burney and White (2007); content validity is the notion that a test should sample range of behaviour that is represented by the theoretical concept being measured.

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It is a non-statistical type of validity with involvement of assessment of the content of the test to ascertain whether it includes the sample representative of the behaviour that is intended to be measured. When a test has content validity, the items on the test represent the entire range of possible items the test should cover. For instance, if researcher wants to develop an achievement test of spelling for the third grade children then a researcher could identify nearly all the possible words that third grade children should know. Individual test items may be taken from a huge group of items that include a broad range of items.

A test has content validity inbuilt in it. Items are selected in accordance with their compliance with the requirements of the test after a careful examination of the subject area.

In certain cases, where a test measures a trait which is difficult to define, an expert can rate the relevance of items. Since, each judge have their own opinion on their rating, two independent judges will rate the test separately. Items which are rated as highly relevant by both judges would be included in the final test.

2.6.2 Criterion-related Validity

Criterion related validity is the idea that a valid test should relate closely to other measure of the same theoretical concept. A valid test of intelligence should correlate highly with other intelligence test. If a test demonstrates effective predicting criterion or indicators of the construct, it is said to possess criterion – related validity. There are two different types of criterion validity-

2.6.2.1 Concurrent Validity

Its occurrence is found when criterion measures are achieved at the same time as the test scores. It reflects the degree to which the test scores estimate the individual's present status with regards to criterion. For instance, if a test measures anxiety, it would be said to have concurrent validity if it rightly reflects the current level of anxiety experienced by an individual. Concurrent evidence of test validity is usually desirable for achievement tests and diagnostic clinical test.

2.6.2.2 Predictive Validity

Predictive validity occurs when criterion measures are obtained at a time after the test. For example, aptitude tests are useful in identifying who will be more likely to succeed or fail in a particular subject. Predictive validity is part curly relevant for entrance examination and occupational test.

2.6.3 Construct Validity

Construct validity approach is complex than other forms of validity. Mc Burney and White (2007) defined construct validity as the property of a test that the measurement actually measures the constructs they are designed to measure. There are several ways to determine whether a test generate data that have construct validity.

- i) The test should actually measure whatever theoretical construct it supposedly tests, and not something else. For example a test of leadership ability should not actually test extraversion.

- ii) A test that has construct validity should measure what it intends to measure but not measure theoretically unrelated constructs. For example, a test of musical aptitude should not require too much reading ability.
- iii) A test should prove useful in predicting results related to the theoretical concepts it is measuring. For example, a test of musical ability should predict who will benefit from taking music lessons, should differentiate groups who have chosen music as a career from those who haven't should relate to other tests of musical ability and so on.

There are two types of construct validity— 'convergent validity' and 'divergent validity' (or discriminant validity).

2.6.3.1 Convergent Validity

It means the extent to which a measure is correlated with other measure which is theoretically predicted to correlate with.

2.6.3.2 Discriminant Validity

This explains the extent to which the operationalisation is not correlated with other operationalisations that it theoretically should not be correlated with.

2.6.4 Face Validity

Face validity refers to what appears to measure superficially. It depends on the judgment of the researcher. Each question is scrutinised and modified until the researcher is satisfied that it is an accurate measure of the desired construct. The determination of face validity is based on the subjective opinion of the researcher.

Self Assessment Questions

Fill in the blanks

- 1) If a test measures what it purports to measure it is called
- 2) If a test is correlated against a criterion to be made available at the present time it is a type of validity known as.....validity.
- 3) The property of a test that measurement actually measure the constructs they are design to measure are known as.....validity
- 4) A test should sample the range of behaviour represented by the theoretical concept being tested, is known as validity.
- 5) refers to what appears to measure superficially.

Answers: (1) Validity (2) Criterion Validity (3) Construct (4) Content
(5) Face Validity

2.6.5 Internal Validity

Internal validity is the most fundamental type of validity because it concerns the logic of the relationships between the independent variable and dependent variable. This type of validity is an estimate of the degree to which inferences about causal relationship can be drawn, based on the measures employed and research design. Properly suited experimental techniques, where the effect of an independent variable upon the dependent one is observed under highly controlled conditions makes possible higher degree of internal validity.

2.6.5.1 Threats to Internal Validity

These include (i) confounding, (ii) selection bias, (iii) history, (iv) maturation, (v) repeated testing, (vi) instrument change, (vii) regression toward the mean, (viii) mortality, (ix) diffusion, (x) compensatory rivalry, (xi) experimenter bias.

- i) *Confounding*: Confounding error that occurs when the effects of two variables in an experiment cannot be separated, resulting in a confused interpretation of the results. Confounding is one of the biggest threat to validity in experimentation. The problem of confounding is particularly acute in research in which the experimenter cannot control the independent variable. When participants are selected according to presence or absence of a condition, subject variable can affect the results. Where a false relationship cannot be avoided, a rival hypothesis may be developed to the original cause and inference hypotheses.
- ii) *Selection bias*: Any bias in selecting a group can undermine internal validity. Selection bias indicates the problem that occurs as a result of its existence at the pre-test differences between groups, may interact with the independent variable and thus influence the observed outcome and creates problems; examples would be gender, personality, mental capabilities, and physical abilities, motivation level and willingness to participate.

If at the time of selection, an uneven number of subjects to be tested have similar subject-related variables, there could be a threat to the internal validity, for instance, if two groups are formed i.e. experimental and control group, the subjects in the two groups are different with regards to independent variable but alike in one or more subject related variables. It would then be difficult for the researcher to identify if the difference between in the groups is the result of independent variable or subject related variable as well as randomisation of group assignment. It is not possible always as some significant variables may go unnoticed.

- iii) *History*: Events outside the experiment or between repeated measures of dependent variables may influence participants' responses, attitudes and behaviour during process of experiment, like; natural disasters, political changes etc. In this condition, it becomes impossible to determine whether change in dependent variable is caused by independent variable or historical event.
- iv) *Maturation*: Usually, it happens that subjects change during the course of an experiment or between measurements. For instance, in longitudinal studies young kids might grow up as a result of their experience, abilities or attitudes which are intended to be measured. Permanent changes [such as physical growth] and temporary changes [like fatigue and illness] may alter the way a subject would react to the independent variable. Thus, researcher may have trouble in ascertaining if the difference is caused by time or other variables.
- v) *Repeated testing*: Participants may be driven to bias owing to repeated testing. Participants may remember correct answers or may be conditioned as a result of incessant administration of the test. Moreover, it also causes possibility of threat to internal validity.
- vi) *Instrument change*: If any instrument is replaced/changed during process of experiment, then it may affect the internal validity as alternative explanation easily available.

- vii) *Regression toward the mean*: During the experiment, if subjects are selected on the basis of extreme scores, then there are chances of occurrence of such an error. For example, when subjects with minimum mathematical abilities are chosen, at the end of the study if there is any improvement chances are that it would be due to regression towards the mean and not due to effectiveness of the course.
- viii) *Mortality*: It should be kept in mind that there may be some participants who may have dropped out of the study before its completion. If dropping out of participants leads to relevant bias between groups, alternative explanation is possible that account for the observed differences.
- ix) *Diffusion*: It might be observed that there will be a lack of differences between experimental and control groups if treatment effects spread from treatment groups to control groups. This, however, does not mean that, independent variable will have no effect or that there would not be a no relationship between dependent and independent variable.
- x) *Compensatory rivalry/resentful demoralisation*: There will be a change in the behaviour of the subject if the control groups alter as a result of the study. For instance, control group participants may work extra hard to see that expected superiority of the experimental group is not demonstrated. Again, this does not imply that the independent variable created no effect or that there would be no relationship between dependent and independent variable. Vice-versa, changes in the dependent variable may only be effected due to a demoralised control group, working less hard or demotivated.
- xi) *Experimenter bias*: Experimenter bias happens while experimenters, without any intention or reluctance, behave differently to the participants of control and experimental groups, that in turn, affect the results of the experiment. Experimental bias can be reduced by keeping the experimenter from knowing the condition in the experiment or its purpose and by standardising the procedure as much as possible.

2.6.6 External Validity

According to McBurney and White(2007), external validity concerns whether results of the research can be generalised to another situation, different subjects, settings, times and so on.

External validity lacks from the fact that experiments using human participants often employ small samples collected from a particular geographic location or with idiosyncratic features (e.g. volunteers). Because of this, it cannot be made sure that the conclusions drawn about cause-effect-relationships are actually applicable to the people in other geographic locations or in the absence of these features.

2.6.6.1 Threat to External Validity

How one may go wrong in making generalisations, is one of the major threats to external validity. Usually, generalisations are limited when the cause (i.e. independent variable) is dependent upon other factors; as a result, all the threats to external validity interact with the independent variable

- a) *Aptitude-Treatment-Interaction*: The sample might have some features that may interact with the independent variable causing to limit generalisability,

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for instance, conclusions drawn from comparative psychotherapy studies mostly use specific samples (example; volunteers, highly depressed, hardcore criminals).

- b) *Situations*: All the situational factors, for example, treatment conditions, light, noise, location, experimenter, timing, scope and degree of measurement etc may limit generalisations.
- c) *Pre-Test Effects*: When the cause-effect relationships can only be found out after the pre-tests are carried out, then, this also tends to limit the generality of the findings.
- d) *Post-Test Effects*: When cause-effect relationships can only be explored after the post-tests are carried out, then this can also be a cause for limiting the generalisations of the findings.
- e) *Rosenthal Effects*: When derivations drawn from the cause-consequence relationships cannot be generalised to other investigators or researchers.

Self Assessment Questions

- | | |
|---|-------|
| 1) Results can not be generalised to another situation or population in external Validity. | T / F |
| 2) Dropping out of some subjects before an experiment is completed causing a threat to internal validity. | T / F |
| 3) Any bias in selecting the groups can enhance the internal validity. | T / F |
| 4) Internal Validity concern the logic of relationship between the independent variable and dependent variable. | T / F |
| 5) Confounding error occurs when the effects of to variable in an experiment can not be separated. | T / F |

Answers: (1) F, (2) T, (3) F, (4) T, (5) T

2.7 LET US SUM UP

In psychological testing, reliability refers to the attribute of consistency of measurement. There are various types of reliability. The Pearson product-moment correlation coefficient can be used to gauge the consistency of psychological test scores. This form of reliability is referred to as test-retest reliability. Alternate-forms reliability is computed by correlating scores on two equivalent forms, administered in counterbalanced fashion to a large group of heterogeneous subjects. Internal consistency approaches to reliability include split-half reliability, in which scores on half tests are correlated with each other, and coefficient alpha, which can be thought of as the mean of all possible split-half coefficients. For tests that require examiner judgment for assignment of scores, inter scorer reliability is needed. Computing inters corer reliability is straightforward: A sample of tests is independently score by two or more examiners and scores for pairs of examiners are then correlated.

The validity of a test is the degree to which it measures what it claims to measure. A test is valid to the extent that inferences made from it are appropriate, meaningful, and useful. There are various kinds of validity – content validity

determine by the degree to which the question, task or items on a test are representative of the universe of behaviour the test was designed to sample. A test has face validity if it looks valid to test users, examiners, and especially the examinees. Criterion-related validity is demonstrated when a test is effective in predicting performance on an appropriate outcome measure. An investigation has internal validity if a cause-effect relationship actually exists between the independent and dependent variables. Confounding occurs when the effects of two independent variables in an experiment cannot be separately evaluated. External validity concerns whether the results of the research can be generalised to another situation: different subjects, settings, times, and so forth. Threats to the internal validity of an experiment include events outside the laboratory, maturation, effects of testing, regression effect, selection and mortality. Threats to external validity include problems arising from generalising to other subjects, other times, or other settings. Experimenter bias can be reduced by keeping the experiment from knowing the conditions in the experiment or its purpose and by standardising procedure as much as possible.

2.8 UNIT END QUESTIONS

- 1) Define reliability. Discuss any two methods of estimating reliability of test scores.
- 2) What is meant by internal consistency reliability. Discuss any two methods of assessing internal consistency reliability.
- 3) What are some problems associated with reliability assessed via the test-retest.
- 4) State the strengths and drawbacks of parallel forms reliability.
- 5) Write short notes on:
 - K-R formula
 - Spearman Brown formula
 - Cronbach alpha
- 6) Define validity and distinguish between reliability and validity.
- 7) Explain construct validity. How does it differ from content validity.
- 8) What is internal validity? Discuss various threats of internal validity.
- 9) What is external validity? Discuss various threats of external validity.
- 10) Write short notes on :
 - Convergent and divergent validity
 - Concurrent and predictive validity

2.9 GLOSSARY

- Concurrent validity** : a type of criterion-related validity in which the criterion measures are obtained at approximately the same time as the test scores.
- Confounding** : error that occurs when the effects of two variables in an experiment cannot be separated, resulting in a confused interpretation of the results.

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Construct	:	a theoretical, tangible quality or trait in which individuals differ.
Construct validity	:	the property of a test that the measurements actually measure the constructs they are designed to measure, but no others.
Content validity	:	idea that a test should sample the range of behaviour represented by the theoretical concept being tested.
Criterion validity	:	idea that a test should correlate with other measures of the same theoretical construct.
Cronback alpha	:	an index of reliability that may be thought of as the mean of all possible split-half co-efficient, corrected by the Spearman-Brown formula.
External validity	:	how well the findings of an experiment generalise to other situations or populations.
Inter observer reliability	:	the typical degree of agreement between scores.
Internal validity	:	Internal consistency: the degree to which the various items on a test are measures of the same thing. : extent to which a study provides evidence of a cause-effect relationship between the independent and dependent variables.
Kuder-Richardson formula 20	:	an index of reliability that is relevant to the special case where each test item is scored 0 or 1 (example, right or wrong)
Maturation	:	a source of error in an experiment related to the amount of time between measurements.
Regression effect	:	regression effect tendency of subjects with extreme score on a first measure to score closer to the mean on a second testing.
Reliability	:	the property of consistency of a measurement that gives the same result on different occasions.
Spearman-Brown formula:	:	a formula for adjusting split-half correlations so that they reflect the full length of a scale.
Split-half reliability	:	a form of reliability in which scores from the two halves of a test (e.g. even items versus odd items) are correlated with one another; the correlation is then adjusted for test length.
Test – retest reliability	:	the degree to which the same test score would be obtained on another occasion.
Validity	:	of a measurement the property of a measurement that tests what it is supposed to test.

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UNIT 3 VARIABLES AND CONSTRUCTS

Structure

- 3.0 Introduction
- 3.1 Objectives
- 3.2 Meaning of Variables
- 3.3 Types of Variables
 - 3.3.1 Stimulus, Organism and Response Variables
 - 3.3.2 Independent and Dependent Variables
 - 3.3.3 Extraneous and Confounded Variables
 - 3.3.4 Active and Attribute Variables
 - 3.3.5 Quantitative and Categorical Variables
 - 3.3.6 Continuous Variables and Discrete Variables
- 3.4 Constructs
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 - 3.5.2 Hypothetical Constructs
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3.0 INTRODUCTION

In the process of formulating a research problem there are two important considerations; the use of constructs/concepts and the construction of hypotheses. Constructs/concepts are highly subjective as their understanding varies from person to person and therefore, as such, may not be measurable. In a research study, it is important that the concepts used should be operationalised in measurable terms so that the extent of variation in respondents understanding is reduced if not eliminated. Knowledge about constructs and variables are very important to understand conceptual clarity and quantitative accuracy as they provide the 'fine tuning' to research.

This unit attempts to acquaint you with the term variables and constructs which are used by the psychologists in gaining knowledge about the behaviour and mental processes. It begins with definition of variables then you will find the details about the types of variables along with the examples. Further, you will be exposed to the nature of the scientific concept or construct and the way in which behavioural scientist travel from the construct level to observation level. Finally, types of constructs are described.

3.1 OBJECTIVES

After reading this unit, you will be able to:

- Define the term variable and construct;

- Discuss the types of variable and constructs;
- Identify different types of variables i.e. independent variable, dependent variable, extraneous variables etc. in a research study;
- Distinguish between variable and constructs; and
- Differentiate hypothetical concept and intervening variable.

3.2 MEANING OF VARIABLES

A variable, as the name implies, is something that varies. This is the simplest way of defining a variable.

Webster says that a variable is “a thing that is changeable” or “a quantity that may have a number of different values.” True, a variable is something that has at least two values: however, it is also important that the values of the variable be observable. Thus, if what is being studied is a variable, it has more than one value and each value can be observed. For example, the outcome of throwing a dice is a variable. That variable has six possible values (each side of the dice having one to six dots on it), each of which can be observed.

However, a behavioural scientist attempts to define a variable more precisely and specifically. Kerlinger (1986) defined variable ‘a property that taken as different values’. According to D’Amato (1970) variables may be defined as those attributes of objects, events, things and beings, which can be measured. According to Postman and Egan (1949) a variable is a characteristic or attribute that can take on a number of values, for example, number of items that an individual solves on a particular test, the speed with which we respond to a signal, IQ, sex, level of anxiety, and different degree of illumination are the examples of variables that are commonly employed in psychological research.

Self Assessment Questions

- | | |
|--|-------|
| 1) Variable is a property that taken as different values. | T / F |
| 2) Unchangeable physiological and psychological characteristics of organism are called the organism variables. | T / F |
| 3) Variable are tangible. | T / F |
| 4) Variables are not related to theoretical concepts. | T / F |
| 5) Variables can be manipulated, controlled or observed by the experimenter. | T / F |

Answers: (1) T, (2) F, (3) T, (4) F, (5) T

Before discussing the types of variables, it is important to know how the variables of study related to theoretical concepts. Because the variables exist in the world but the theory is an idea, researcher makes certain assumption to relate the two. These assumptions are guide ropes that tie a theory to the real world. The variables are tangible: duration, frequency, rate, or intensity of bar presses; items checked on a questionnaire; murders committed; books written. The theoretical concept is intangible: hunger, motivation, anxiety. The variables are related to the theoretical concepts by means of the operational definitions used to measure the concepts.

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Suppose a theory reveals that increasing anxiety will increase the affiliation motive. To test out this theory, you may take the theoretical concepts of anxiety and affiliation motive and relate them to variables by means of operational definitions. The theory is an abstract statement. For example, anxiety can be measured by the Anxiety Scale and affiliation by how close people sit to each other in the experiment. These two measures constitute the variables of the study. The scores on the variables of anxiety and distance apart are related to one another as test of the hypothesis. The relationship between the variable is taken as providing support for or against the particular theory that generated the experiment.

3.3 TYPES OF VARIABLES

To understand how variables are used and discussed in psychological researches, you would like to understand several distinctions that are made among the type of variables. The descriptions of different types of variables are given below:

3.3.1 Stimulus, Organism and Response Variables

Psychologists are interested in studying the behaviour or causes of behaviour as variables. Many psychologists have adopted a theoretical viewpoint or model called the **S-O-R** model to explain all behaviour. The symbols **S**, **O**, and **R** represent different categories of variables. **S** is the symbol of stimuli, and the category may be referred to in general as stimulus variables. A stimulus variable is some form of energy in the environment, such as light, to which the organism is sensitive. **O** is the symbol for organism variables, that is the changeable physiological and psychological characteristics of the organisms being observed. Examples of such variables are anxiety level, age and heart rate etc. Finally, **R** is the symbol for response and, in general, response variables, which refer to some behaviour or action of the organism like pressing a lever, and reaction to any stimulus, are the examples of responses variables. You can understand an application of **S-O-R** model through the following example.

Suppose that an experiment is conducted in which a rat is placed on a metal grid floor, the grid is electrified, and the length of time it takes the rat to jump from the grid to a platform is measured. Using the **S-O-R** model, the electrical shock would be called a stimulus variable. The intensity of shock would be the value of the variable. The particular state of the organisms would be measured by the organismic variables. For example, the skin resistant of the rat at the time of shock was introduced would be an organismic variables. A response variable would be the latency (i.e. the elapsed time between the onsets of the shock and when the rat reaches the platform).

3.3.2 Independent and Dependent Variables

An *independent variable* or stimulus variable (as Underwood calls it) is that factor manipulated or selected by the experimenter in his attempt to ascertain its relationship to an observed phenomenon.

Dependent upon the mode of manipulation, some experts have tried to divide the independent variable into 'Type E' independent variable and 'Type S' independent variable (D'Amato, 1970). Type E independent variable is one of which is directly or experimentally manipulated by the experimental and type S

independent variable is one which is manipulated through the process of selection only. For example the experimenter wants to study the effect of noise upon the task performance in an industry. Here the IV (Independent Variable) is the noise and the DV(Dependent Variable) is the task performance. He may manipulate the noise by dividing into three categories — continuous noise, intermittent noise and no noise and examine its effect upon the task performance. Here the noise is being directly manipulated by the experimenter and hence, it constitutes the example of Type-E independent variable. Suppose, for the time being, that the experimenter is interested in answering the question: Is the rate of production dependent upon the age of the workers? Age is here the independent variable. For investigating this problem, the experimenter will have to select groups of workers on the basis of their age in a way by which he can get an appropriate representation from different age groups ranging from say, 16 to 55 years. Subsequently, he will compare the rate of production obtained by each age group and finally, conclude whether or not age is a factor in enhancement of the performance .Hence this constitutes the examples of S-independent variables.

A *dependent variable* is the factor that appears, disappears, or varies as the experimenter introduces, removes or varies the independent variable. (Townsend,1953). The dependent variable is a measure of the behaviour of the subject. The dependent variable is the response that the person or animal makes. This response is generally measured using at least one of several different dimensions (Alberto & Troutman 2006). The dimensions are – (a) frequency – Number of times that a particular behaviour occurs, (b) duration - the amount of time that a behaviour lasts. (c) latency –the amount of time between and when the behaviour is actually performed (d) force – the intensity or strength of a behaviour.

Here, you can examine the relationship between independent and dependent variables. The relationship is that of dependence. One variable depends upon the other. Suppose you find a relationship between meaningfulness of the learning material and speed of learning. Speed of learning then depends upon meaningfulness; the greater the meaningfulness, the faster the learning. The speed of learning is, therefore, called dependent variable; meaningfulness is independent variable. Similarly, rest between work periods is independent variables; output of work is dependent variable. Sudden noise is independent variable; change in breathing is dependent variable. In an experiment one discovers and confirms a relationship between an independent variable and a dependent variable.

Self Assessment Questions

Identify the independent and dependent variables?

- 1) As the number of trials increases error decreases.

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- 2) Intensity of lights affects the task performance.
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- 3) Healthy parent child relationship facilitated emotional adjustment of the children.
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- 4) Teaching methods affects learning.
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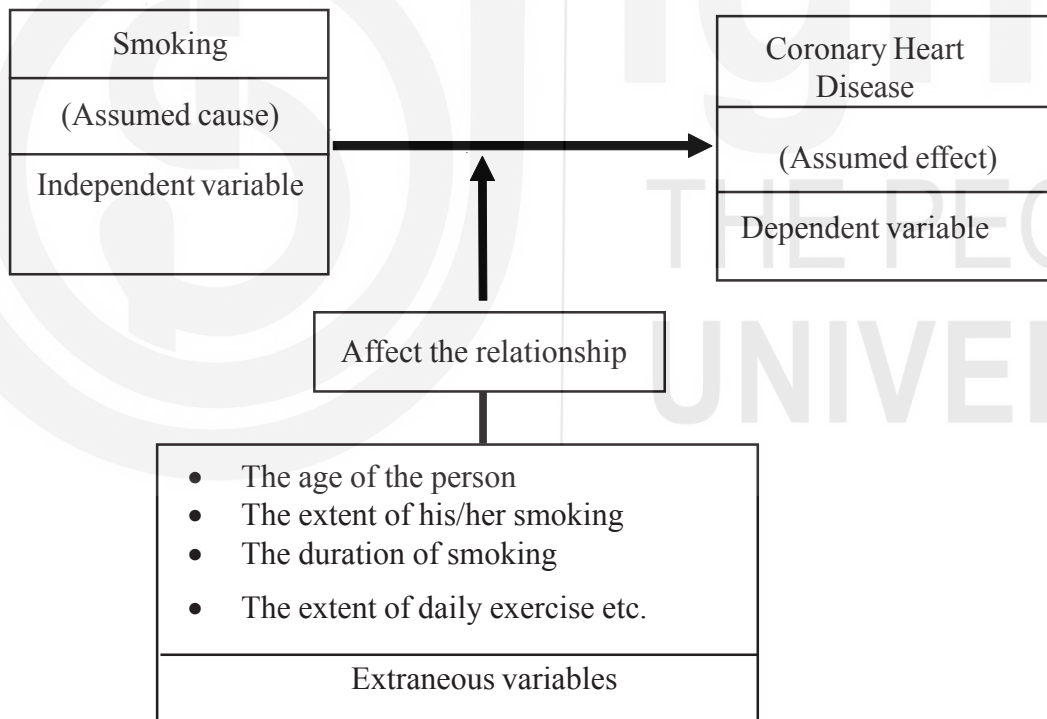
3.3.3 Extraneous and Confounded Variables

Any and all other variables that may ‘mask’ the relationship between independent variable and dependent variable are known as extraneous variables. *Extraneous variables* may directly affect the dependent variable or may combine with the independent variable to produce an affect. Therefore, extraneous variables must be controlled so that the experimenter can determine whether the dependent variable changes in relation to variation in the independent variable. Several others factors operating in a real life situation may affect changes in the dependent variable. These factors, not measured in the study, may increase or decrease the magnitude or strength of the relationship between independent and dependent variables. Extraneous variables are relevant in nature, and in experimental studies, they belong to three major types i.e., organismic variables, situational variables and sequential variables. The subject related variables include age, sex, intelligence, personality etc. are organismic variables. The situational variables include environmental variables operating in the experimental setting (e.g. noise, temperature, humidity) and variables related to the experimental task. The sequence related variables deal with sequence effects. They arise when participants in experiments are required to be tested in several conditions. Exposure to many conditions may result in adaptation, fatigue or practice effects which, if allowed to operate, may make the results difficult to interpret.

Confounding variables is one that varies with the independent variable. While doing a study if we are not careful then two variables may get combined so that the effect of one cannot be separated from the effect of other. This is known as confounding. For instance, if you conducted a study of the effect of television viewing on perception of violence and the experimental group contained only adolescents, whereas the control group only adults, the age of participants would be confounded with the independent variable under study. Confounding makes the conclusions of the study doubtful. It is, therefore, necessary that effort should be made to unconfound the variables.

To explain these variables let us take one example. Suppose you want to study the relationship between smoking and coronary heart disease. You assume that affecting this relationship, such as a number of cigarettes or the amount of tobacco smoked every day; the duration of smoking; the age of the smoker; dietary habits; and the amount of exercise undertaken by the individuals. All of these factors may affect the extent to which smoking might cause coronary heart disease. These variables may either increase or decrease the magnitude of the relationship. In this example, the extent of smoking is the independent variable, coronary heart disease is the dependent variable and all the variables that might affect this relationship, either positively or negatively, are extraneous variables.

Independent, dependent & extraneous variables in a causal relationship



3.3.4 Active and Attribute Variables

Any variable that is manipulated is called *active variables*. Examples of active variables are reward, punishment, methods of teaching, creating anxiety through instructions and so on. *Attribute variable* is that variable which is not manipulated but measured by the experimenter. Variables that are human characteristics like intelligence, Aptitudes, sex, socio economic status, education, field dependence and need for achievement are the example of attributes variables. The word 'attribute' is more accurate enough when used within animated objects or references. Organisations, institutions, groups, population and geographical areas

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have attributes. Organisations are variably productive; groups differ in cohesiveness; geographical areas vary widely in resources.

3.3.5 Quantitative and Categorical Variables

Quantitative variables is one that varies in amount whereas categorical variables varies in kind. Speed of response, intensity of sound, level of Illumination, intelligence etc. are the example of quantitative variables and gender, race, religion are the example of categorical variables. Precise and accurate measurement are possible with the quantitative variables because they can be easily ordered in terms of increasing and decreasing magnitude categorical variables can be of three types: Constant, dichotomous and polytomous.

When a variable can have only one value or category, for example taxi, tree and water, it is known as a constant variables. When a variable can have only two categories as in yes/no, good/bad and rich/poor, it is known as dichotomous variables. When variables can be divided into more than two categories, for example: religion (Christian, Muslim, Hindu); political parties (Labor, Liberal, Democrat); and attitudes (strongly favorable, favorable, uncertain, unfavorable, strongly unfavorable), it s called a polytomous variable.

Self Assessment Questions

- 1) The event manipulated or altered by the experimenter is termed as
.....
- 2) The is the response that the person or animal makes.
- 3) Any and all other variables that may mask the relationship between independent variable and dependent variables are known as
- 4) Manipulated variables are called and measures variable are called
- 5) is one that varies in amount whereas varies in kind.

Answer: (1) Independent variables (2) Dependent variables (3) Extraneous variables (4) Active variables, Attribute variables (5) Quantitative variables & Categorical variables.

3.3.6 Continuous Variables and Discrete Variables

Quantitative variables are further divided into two categories, namely, continuous variables and discrete variables. A distinction between continuous and discrete variables is especially useful in planning of research and analysis of data. A *continuous variable* is one which is capable of being measured in any arbitrary degree of fineness or exactness. Age, height, intelligence, reaction time, etc., are some of the examples of a continuous variable. The age of the person can be measured in years, month and days. Thus, all such variables which can be measured in the smallest degree of fineness are called continuous variable. The *discrete variables* are those variables which are not capable of being measured in any arbitrary degree of fineness or exactness because the variables contain a clear gap. For example, the number of members in a family, no. of females in particular group, no of books in library and so on constitutes the examples of a discrete variable.

Activity -1

Check whether the following are continuous or discrete variables:

	C	D
a) the bar presses that a rat makes in a Skinner box	()	()
b) the height of six-year-old boys and girls in Chicago	()	()
c) the score you make on a true-false exam	()	()
d) the distance various people can travel in 5 hours	()	()

Activity -2**Identity Types of Variables**

A researcher wants to administer an intelligence test to 30 college students. After collecting information on subjects' age, sex, height, weight, political preference, career goals, and socioeconomic status, the researcher administers and attitude survey on current issues to all 30 subjects.

Required:

Identify examples of the following types of variables in the paragraph and the scales by which they would be measured:

- a) discrete
- b) continuous
- c) categorical
- d) quantitative

3.4 CONSTRUCTS

The terms 'concept' and 'construct' have similar meanings. Yet, there is an important distinction. A concept may be defined as any describable regularity of real or imagined events or objects (Bourne, Ekstrand, & Dominowski, 1971). A concept is a set of features connected by some rule (Hulse, Egeth, Deese 1980) Concepts are building block of thinking. They allow us to organise knowledge in systematic ways. Concept represents objectives of activities, ideas or living organism. Concept also represents properties, abstraction and relations between the features. For example – 'achievement'. It is an abstraction formed from the observation of certain behaviours of children. These behaviours are associated with the mastery or "learning" of school tasks – reading words, doing arithmetic problems, drawing pictures, and so on. The various observed behaviours are put together and expressed in a word – 'achievement'. 'Intelligence', 'aggressiveness', 'conformity', and 'honesty' are all concepts used to express varieties of human behaviour of interest to behavioural scientists. Researcher often invents or constructs new concepts for special scientific purposes; such concepts are called constructs.

Thus, you may well explain construct as concept. It has the added meaning i.e invented or adopted for a special scientific purpose. For example, "Intelligence" is a concept, an abstraction from intelligent and nonintelligent behaviours. But, as a scientific construct, "intelligence" means both more and less than a concept. It means that scientists consciously and systematically use it in two ways. One, it

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enters into theoretical schemes and related in various ways to other constructs. In this sense, school achievement may also be, in part, a function of intelligence and motivation. Two, “intelligence” is so defined and specified that it can be observed and measured. We can make observations of the intelligence of children by administering X intelligence test to them, or we can ask teachers to tell us the relative degrees of intelligence of their pupils.

Constructs are created and used for a wide variety of reasons, but generally have two common characteristics. First, the construct is a part of a theoretical framework and is related in various ways to other constructs. Second, a construct usually operationally defined so as to allow its observation and measurement. An example of a commonly employed psychological construct would be reinforcement. On a theoretical level, reinforcement can be, and is, related to other constructs such as drive, motivation, association, and habit strength.

Further reinforcement may be operationally defined as any stimulus or event which increases the probability of the occurrence of a (desired) response.

3.5 TYPES OF CONSTRUCTS

As Mac-Corquodale & Meehl, (1948) Indicated that there are two types of constructs which are often employed by psychologist and behavioural scientist:

Intervening variables

Hypothetical construct

3.5.1 Intervening Variables

An intervening variable is construct which is utilised as a summary term for a group of other construct; It has no meaning apart from context in which it is utilised. As you know, Clark Hull, a behaviourist who proposed hypothetical deductive method of learning, utilised intervening variables in the formation of the learning theory. Hull defined reaction potential as the combination of habit strength and drive (Hilgard & Bower, 1966). Reaction potential is an intervening variable, since it only summarizes other constructs (habits strength and drive) and has meaning only in relation to them. An example of intervening variable is, hostility which is inferred from hostile and aggressive acts.

3.5.2 Hypothetical Constructs

In contrast, a hypothetical construct is a theoretical term which is employed to describe something “real.” That is, it is an intermediary which has tangible characteristics. Habit strength, defined by Hull as the number of reinforced trials, is a hypothetical construct. As another example, the word “reflex” refers to certain readily observable characteristics. The patellar reflex or “knee jerk” occurs when a small force is sharply applied at the appropriate point on the knee. The term “reflex” refers to the chain of events that occurs within the organism after the application of the stimulus and before the response. Hence, reflex is a hypothetical construct.

As a further example, suppose an equation could be developed which would tell us how much a person knows:

$$K = AC \times IQ$$

Where:

K = knowledge

AC = amount of conditioning

IQ = intelligence

AC could be defined as the number of reinforced trials a person receives and IQ as that person's score on a standard intelligence test. K could be defined as being a function of AC and IQ. Therefore, AC and IQ are hypothetical constructs (they describe something real and are defined directly by the operations that established them or by which they were measured). On the other hand, K is an intervening variables (it has no meaning of its own, but only summarizes or stands for other constructs). However, if K were defined as the number of correct solutions a person achieved on the "knowledge test," then K would also be a hypothetical construct.

Self Assessment Questions

Which of the following constructs (as used) would be classified as an Intervening Variable(IV) or a Hypothetical Construct (HC)?

	IV	HC
1) Thinking is the mental activity leading to problem solving.	()	()
2) Arousal is the increase in neural activity in the lower brain stem following stimulation.	()	()
3) A reinforcement is something that makes you want to repeat the behaviour that was rewarded.	()	()
4) The id is the deepest part of the psyche and motivates our "base" desires.	()	()

3.6 LET US SUM UP

Knowledge of different types of variables and constructs play a crucial role in research. Variables and constructs are important in bringing clarity and specificity to the conceptualising of a research problem, to formulation of hypothesis and to the development of a research instrument. They affect how the data can be analysed, what statistical test can be applied to the data, what interpretation can be made and what conclusion can be drawn. A variable is some property of an event that takes on different values. There are different kinds of variables such as independent variables, dependent variables, quantitative variables and categorical variables, active and attribute variables, continuous and discrete variables, extraneous and intervening variables and so on. A construct is a concept. It has an added meaning and it is adopted for a special scientific purpose. Constructs are of two types; intervening and hypothetical constructs. Intervening variables is a term which is internal and directly unobservable psychological processes that, in turn, inferred from behaviour. A hypothetical construct is a theoretical term which is employed to describe something "real." That is, it is an intermediary which has tangible characteristics.

3.7 UNIT END QUESTIONS

- 1) Defined variable and discuss the various kinds of variable.
- 2) Explain Intervening variables and Hypothetical constructs in your own words.
- 3) Differentiate between variables and constructs. Giving suitable example elucidate the different types of variables.
- 4) Write short notes on any two:
 - i) Independent & dependent variables.
 - ii) Quantitative & categorical variables.
 - iii) Active & attribute variables.
- 5) Explain the nature of extraneous variable with suitable examples.

3.8 GLOSSARY

Variable	: A variable is a property that taken as different values.
Independent variables	: The condition manipulated or selected by the experimenter to determine its effect on behaviour.
Dependent variables	: A measure of the subject's behaviour that reflects that independent variable's effects.
Quantitative variable	: One that varies in amount.
Categorical variable	: One that varies in kind.
Continuous variable	: One that falls along a continuum and is not lifted to a certain number of values.
Discrete variable	: One that falls into separate bins with no intermediate values possible.
Active variables	: Manipulated variables are active variables.
Attribute variables	: Measured variables are attribute variables.
Constructs	: Is a concept, used for scientific purpose, is a part of theoretical framework.
Intervening variables	: Is a construct which is utilised as a summary term for a group of other constructs.
Hypothetical constructs	: Is a theoretical term which is employed to describe something real.

3.9 SUGGESTED READINGS AND REFERENCES

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UNIT 4 HYPOTHESIS FORMULATION AND SAMPLING

Structure

- 4.0 Introduction
- 4.1 Objectives
- 4.2 Meaning and Characteristics of Hypothesis
- 4.3 Formulation of Hypothesis
- 4.4 Possible Difficulties in Formulation of a Good Hypothesis
- 4.5 Types of Hypotheses
 - 4.5.1 Null Hypothesis
 - 4.5.2 Alternative Hypothesis
- 4.6 Errors in Testing a Hypothesis
- 4.7 Importance of Hypothesis Formulation
- 4.8 Sampling
 - 4.8.1 Definition of Sampling
 - 4.8.2 Sampling Terminology
 - 4.8.3 Purpose of Sampling
- 4.9 Sampling Methods
 - 4.9.1 Non Probability Sampling
 - 4.9.2 Probability Sampling
- 4.10 Importance of Sampling
- 4.11 Let Us Sum Up
- 4.12 Unit and Questions
- 4.13 Glossary
- 4.14 Suggested Readings and References

4.0 INTRODUCTION

Scientific process or all empirical sciences are recognised by two inter-related concepts, namely; (a) context of discovery (getting an idea) and (b) context of justification (testing and results). Hypotheses are the mechanism and container of knowledge moving from the unknown to known. These elements form techniques and testing ground for scientific discovery. Hypotheses are tentative explanation and potential answer to a problem. Hypothesis gives the direction and helps the researcher interpret data. In this unit, you will be familiarised with the term hypothesis and its characteristics. It is, then, followed by the hypothesis formulation and types of hypothesis. Errors in hypothesis testing are also highlighted.

Further, In order to test the hypothesis, researcher rarely collects data on entire population owing to high cost and dynamic nature of the individual in population. Therefore, they collect data from a subset of individual – a sample - and make the inferences about entire population. This leads us to what we should know about the population and sample. So, researcher plans sample design and uses

various method of sampling. This unit will acquaint you with the meaning of sampling and basic terminology which is used in sampling design.

Now, it will move to purpose of sampling. And finally, various probability and non-probability sampling methods along with advantages and disadvantages are described.

4.1 OBJECTIVES

After reading this unit, you will be able to:

- Define and describe hypothesis and its characteristics;
- explain formulation of hypothesis;
- Enumerate the possible difficulties in formulating hypothesis;
- Explain types of hypotheses;
- Identify in hypotheses testing;
- Define sampling;
- Explain the purpose of sampling; and
- Analyse various probability and non-probability sampling methods.

4.2 MEANING AND CHARACTERISTICS OF HYPOTHESIS

In conducting research, the important consideration after the formulation of a research problem is the construction of hypothesis. As you know, any scientific inquiry starts with the statement of a solvable problem, when the problem has been stated, a tentative solution in the form of testable proposition is offered by the researcher.

Hypothesis is often considered a tentative and testable statement of the possible relationship between two or more events / variables under investigation.

According to Mcguigan (1990), 'a testable statement of a potential relationship between two or more variables, i.e. advance as potential solution to the problem'. Kerlinger (1973) defined 'a hypothesis is a conjectural statement of the relation between two or more variables'. In order to be useful in any study, the hypothesis needs to be stated in such a way that it might be subjected to empirical testing. The researcher is responsible to suggest or find some way to check how the hypothesis stands against empirical data. When a hypothesis is formulated, the investigator must determine usefulness of the formulated hypothesis. There are several criteria or characteristics of a good research hypothesis. A good hypothesis is one which meets such criteria to a large extent. Some of these characteristics are enumerated below:

- 1) Hypothesis should be conceptually clear;
- 2) Hypothesis must be testable;
- 3) Hypothesis should be related to the existing body or theory and impact;
- 4) Hypothesis should have logical unity and comprehensiveness;
- 5) Hypothesis should be capable of verification; and
- 6) Hypothesis should be operationisable.

4.3 FORMULATION OF HYPOTHESIS

Science proceeds with observation, hypothesis formulation and hypothesis testing. After testing the hypothesis, through various statistical tests, researcher can accept or reject the hypothesis. If the hypothesis is accepted then researcher can replicate the results, if hypothesis is rejected then researcher can refined or modify the results.

By stating a specific hypothesis, the researcher narrows the focus of the data collection effort and is able to design a data collection procedure which is aimed at testing the plausibility of the hypothesis as a possible statement of the relationship between the terms of the research problem.

It is, therefore, always useful to have a clear idea and vision about the hypothesis. It is essential for the research question as the researcher intends to verify, as it will direct and greatly help to interpretation of the results.

4.4 POSSIBLE DIFFICULTIES IN FORMULATION OF A GOOD HYPOTHESIS

There are three major possible difficulties; a researcher could face during formulation of hypothesis. First, the absence of knowledge of a theoretical framework is a major difficulty in formulating a good research hypothesis. Second, if detailed theoretical evidences are not available or if the investigator is not aware of the availability of those theoretical evidences, a research hypothesis cannot be formulated. Third, when the investigator is not aware of the scientific research techniques, she/he will not be able to frame a good research hypothesis.

Despite these difficulties, the investigator attempts in her/his research to formulate a hypothesis. Usually the hypothesis is derived from the problem statement. The hypothesis should be formulated in a positive and substantive form before data are collected. In some cases additional hypothesis may be formulated after collection of data, but they should be tested on a new set of data and not on the old set which has suggested it. The formulation of a hypothesis is a creative task and involves a lot of thinking, imagination and innovation. Reichenbach (1938) has made a distinction between the two processes found commonly in any hypothesis formulation task. One is the context of discovery and another is the context of justification. The manner or the process through which a scientist arrives at a hypothesis illustrates the context of justification. A scientist is concerned more with a context of justification in the development of a hypothesis. He never puts his ideas or thoughts as they nakedly occur in the formulation of a hypothesis. Rather, he logically reconstructs his ideas or thoughts and draws some justifiable inferences from those ideas and thoughts. He never cares to relate how he actually arrived at a hypothesis. He does not say, for example, that while he was shaving, this particular hypothesis occurred to him. He usually arrives at a hypothesis by the rational reconstruction of thoughts. When a scientist reconstructs his thoughts and communicates them in the form of a hypothesis to others, he uses the context of justification. When he arrives at a hypothesis, he extensively as well as intensively surveys a mass of data, abstracts them, tries to find out similarities among the abstracted data and finally makes a generalisation or deduces a preposition in the form of a hypothesis.

Here is an important distinction to be made between formulating a hypotheses and choosing one. Although a researcher often becomes interested in a question about human behaviour for personal reasons, the ultimate value of research study depends on the researcher bringing methodological criteria to bear on the selection of the hypothesis to be tested. In other words, Good hypothesis are made, not born.

Hypothesis plays a key role in formulating and guiding any study. The hypotheses are generally derived from earlier research findings, existing theories and personal observations and experience. For instance, you are interested in knowing the effect of reward on learning. You have analysed the past research and found that two variables are positively related. You need to convert this idea in terms of a testable statement. At this point you may develop the following hypothesis.

Those who are rewarded shall require lesser number of trials to learn the lesson than those who are not rewarded.

A researcher should consider certain points while formulating a hypothesis:

- i) Expected relationship or differences between the variables.
- ii) Operational definition of variable.
- iii) Hypotheses are formulated following the review of literature

The literature leads a researcher to expect a certain relationship.

Hypotheses are the statement that is assumed to be true for the purpose of testing its validity.

As suggested by Russell and Reichenback (1947), the hypotheses should be stated in the logical form on the general implications. A hypothesis can be put in the form of an if then statement; if A is true then B should follow. For example, verbal development theory of amnesia states that childhood amnesia caused by the development of language. To test this theory, researcher can make a hypothesis like this – if the lack of verbal ability is responsible for childhood amnesia, then the children should not be able to verbally recall events usually words that they did not know at the time of events.

Self Assessment Questions**Fill in the blanks**

- 1) Hypothesis is considered as and statement of the possible relationship between two or more variables.
- 2) Hypothesis can be put in the form of an if statement.
- 3) Hypothesis is formulated..... to review of literature.
- 4) of knowledge of a theoretical framework is a major difficulty in formulating a hypothesis.
- 5) Formulation of a hypothesis enhances in the study.

Answers: (1) tentative, testable, (2) then, (3) Prior, (4) Absence, (5) Objectivity.

4.5 TYPES OF HYPOTHESES

As explained earlier, any assumption that you seek to validate through investigation is called hypotheses. Hence theoretically, there should be one type of hypotheses on the basis of the investigation that is, research hypothesis. However, because of the conventions in scientific enquiries and wording used in the constructions of the hypothesis, Hypotheses can be classified into several types, like; universal hypotheses, existential hypotheses, conceptual hypotheses etc. Broadly, there are two categories of the hypothesis:

- i) Null hypothesis
- ii) Alternative hypothesis

4.5.1 Null Hypothesis

Null hypothesis is symbolised as H_0 . Null hypothesis is useful tool in testing the significance of difference. In its simplest form, this hypothesis asserts that there is no true difference between two population means, and the difference found between sample means is, accidental and unimportant, that is arising out of fluctuation of sampling and by chance. Traditionally null hypothesis stated that there is zero relationship between terms of the hypothesis. For example, (a) schizophrenics and normal do not differ with respect to digit span memory (b) There is no relationship between intelligence and height.

The null hypothesis is an important component of the decision making methods of inferential statistics. If the difference between the samples of means is found significant the researcher can reject the null hypothesis. It indicates that the differences have statistically significant and acceptance of null hypothesis indicates that the differences are due to chance. Null hypothesis should always be specific hypothesis i.e. it should not state about or approximately a certain value.

The null hypothesis is often stated in the following way:

$$H_0: \mu_{HV} \leq \mu_{LV}$$

Thus, the null hypothesis is that mean of the population of those children who have the high vocabulary (group1) is less than or equal to mean of those who lack the vocabulary (Group 2).

4.5.2 Alternative Hypothesis

Alternative hypothesis is symbolised as H_1 or H_a , is the hypothesis that specifies those values that are researcher believes to hold true, and the researcher hopes that sample data will lead to acceptance of this hypothesis as true. Alternative hypothesis represents all other possibilities and it indicates the nature of relationship.

The alternative hypothesis is stated as follows:

$$H_1: \mu_{HV} > \mu_{LV}$$

The alternative hypothesis is that the mean of population of those who have the vocabulary is greater than the mean of those to lack the vocabulary. In this example the alternative hypothesis is that the experimental population had higher mean than the controls. This is called directional hypothesis because researcher predicted

that the high vocabulary children would differ in one particular direction from the low vocabulary children. Sometimes researcher predicts only that the two groups will differ from each other but the researcher doesn't know which group will be higher. This is non directional hypothesis.

The null and alternative hypothesis in this case would be stated as follows:

$$H_0: \mu_1 = \mu_2$$

$$H_1: \mu_1 \neq \mu_2$$

Thus, the null hypothesis is that mean of group 1 equals the mean of group 2, and the alternative hypothesis is that the mean of group 1 does not equal the mean of group 2.

4.6 ERRORS IN TESTING A HYPOTHESIS

You have already learned that hypotheses are assumptions that may be prove to be either correct or incorrect. It is possible to arrive at a incorrect conclusion about a hypothesis for the various reasons if –

- Sampling procedure adopted faulty
- Data collection method inaccurate
- Study design selected is faulty
- Inappropriate statistical methods used
- Conclusions drawn are incorrect

Two common errors exist when testing a hypothesis.

Type I error – Rejection of a null hypothesis when it is true.

Type II error - Acceptance of a null hypothesis when it is false.

Self Assessment Questions (State True and False)

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|---|-------|
| 1) Null hypothesis is denoted by H_1 . | T/F |
| 2) If the hypothesis is accepted then researcher can replicate the results. | T/F |
| 3) Rejection of a null hypothesis when it is true is called type II error. | T / F |
| 4) Hypothesis can be stated directional and non directional. | T / F |
| 5) Alternative hypothesis specifies values that researcher believes to hold true. | T / F |

Answers : (1) F, (2) T, (3) F, (4) T, (5) T

4.7 IMPORTANCE OF HYPOTHESIS FORMULATION

Hypothesis is the basic function of the scientific research. If simple, brief and clear scientific hypothesis has been formulated, there shall be no problem for the investigator to proceed in the research field. Its utility or importance for and research may be studied as under.

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Accordingly to Goode and Hatt ('without' hypothesis formulation the research is unfocussed, a random empirical wandering. The results can not be studied as facts with clear meaning. Formulation of hypothesis links between theory and investigation which lead to discovery of addition to knowledge.

Self Assessment Questions

Study the following research questions and state the possible hypothesis with specify their types specify their types.

- 1) Is physical attractiveness related to friendship?

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- 2) Does meaningful of material affect the rate of learning?

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- 3) Does reinforcement improve the learning for solving simple discrimination task?

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- 4) Does onset of fatigue reduce the efficiency of the worker?

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4.8 SAMPLING

Researchers usually can not make direct observation of every individual in the population under study. Instead, they collect data from a subset of individuals- a sample – and use those observations to make inferences about the entire population.

Ideally, the sample corresponds to the larger population on the characteristics of (s) of interest. In that case, the researcher's conclusions from the samples are properly applicable to the entire population.

Sampling is the process of selection of units (e.g. people, organisation) from a population of interest so that by studying the sample may fairly generate results back to the population from which they were chosen.

4.8.1 Definition of Sampling

According to Young (1992) “A statistical sample is miniature picture of cross selection of the entire group or aggregate from which the sample is taken”.

According to Goode and Hatt(1981) “A sample, as the name implies, is a smaller representative of a large whole”.

According to Blalock (1960) “It is a small piece of the population obtained by a probability process that mirrors with known precision, the various patterns and sub-classes of population”.

4.8.2 Sampling Terminology

Before we explain the purpose, uses and method of sampling, it will be better to describe those fundamental terms which are concerned to sampling concepts and principles.

Population: Population is a well defined set up of all elements pertaining to a given characteristic. It refers to the whole that include all observations or measurements of a given characteristic. Population is also called universe or population. It may be defined as any identifiable and well specified group of individual for example. All primary teachers, nonnumber of all college teachers and all university students are the example of population. A population may be finite or infinite.

A finite population is one where all the members can be easily counted. An infinite population is one whose size is unlimited, and can not count easily. Population of college teachers is an example of finite population and production of wheat, and fishes in river are the example of infinite population. A measure based upon the entire population is called a parameter.

Sample: A sample is any number of persons selected to represent the population according to some rule of plan. Thus, a sample is a smaller representation of the population. A measure based upon a sample is known as a statistic.

Sample size: No. of selected individual for example, no. of students, families from whom you obtain the require information is called the sample size and usually denoted by the letter (n).

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Sampling design or strategy: The way researcher selects the sample or students or families etc. is called the sampling design and strategy. It refers to the techniques or procedures the researcher would adopt in selecting some sampling units from which inferences about the population are drawn.

Sampling unit: Each individual or case that becomes the basis for selecting a sample is called sampling unit or sampling elements.

Sampling frame: The list of people from which the sample is taken. It should be comprehensive, complete and up-to-date. Examples of sampling frame: Electoral Register; Postcode Address File; telephone book.

Self Assessment Questions (Fill in the blanks)

- 1) Any identifiable and well specified group of individual is known as
- 2) List of all the units of the population is called
- 3) Purposes of sampling is to derive the desired information about the population at the minimum and maximum
- 4) The way the researcher selects the sample is known as
- 5) is the miniature picture of entire group.

Answers: (1) population, (2) sampling frame, (3) cost, reliability, (4) sampling design, (5) sample.

4.8.3 Purpose of Sampling

The objective of sampling is to derive the desired information about the population at the minimum cost or with the maximum reliability. Further, the aims in selecting a sample are to achieve maximum precision in estimates within a given sample size and to avoid bias in the selection of sample. Bias in the selection of sample can take place if: (a) the researcher selects the sample by non random method and influenced by human choice. (b) The researcher does not cover the sampling population accurately and completely (c) A section of a sample population is impossible to find or refuses to cooperate.

4.9 SAMPLING METHODS

Blalock (1960) indicated that most sampling methods could be classified into two categories:

- i) Non probability sampling methods
- ii) Probability sampling methods

4.9.1 Non Probability Sampling Methods

Non probability sampling is one in which there is no way of assessing the probability of the element or group of elements, of population being included in the sample. In other words, non-probability sampling methods are those that provide no basis for estimating how closely the characteristics of sample approximate the parameters of population from which the sample had been obtained. This is because non probability sample do not use the techniques of random sampling. Important techniques of non probability sampling methods are:

i) Haphazard, Accidental, or Convenience Sampling

Haphazard sampling can produce ineffective, highly unrepresentative samples and is not recommended. When a researcher haphazardly selects cases that are convenient, he or she can easily get a sample that seriously misrepresents the population. Such samples are cheap and quick; however, the systematic errors that easily occur make them worse than no sample at all. The person-on-the-street interview conducted by television programs is an example of a haphazard sample. Likewise, television interviewers often select people who look “normal” to them and avoid people who are unattractive, poor, very old, or inarticulate. Such haphazard samples may have entertainment value, but they can give a distorted view and seriously misrepresent the population.

For example, an investigator may take student of class X into research plan because the class teacher of the class happens to be his / her friend. This illustrates accidental or convenience sampling.

ii) Quota Sampling

Quota Sampling is an improvement over haphazard sampling. In quota sampling, a researcher first identifies relevant categories of people (e.g., male and female; or under age 30, ages 30 to 60, over age 60, etc.), then decides how many to get in each category. Thus, the number of people in various categories of the sample is fixed. For example, a researcher decides to select 5 males and 5 females under age 30, 10 males and 10 females aged 30 to 60, and 5 males and 5 females over age 60 for a 40-person sample. It is difficult to represent all population characteristics accurately.

Quota sampling ensures that some differences are in the sample. In haphazard sampling, all those interviewed might be of the same age, sex, or background. But, once the quota sampler fixes the categories and number of cases in each category, he or she uses haphazard or convenience sampling. Nothing prevents the researcher from selecting people who act friendly or who want to be interviewed. Quota sampling methods are not appropriate when the interviewers choose who they like (within above criteria) and may therefore select those who are easiest to interview, so, sampling bias can take place. Because not using the random method, it is impossible to estimate the accuracy. Despite these limitations, quota sampling is a popular method among non-probability methods of sampling, because it enables the researcher to introduce a few controls into his research plan and this methods of sampling are more convenient and less costly than many other methods of sampling.

iii) Purposive sampling

Purposive sampling is a valuable kind of sampling for special situations. It is used in exploratory research or in field research. It uses the judgment of an expert in selecting cases or it selects cases with a specific purpose in mind. With purposive sampling, the researcher never knows whether the cases selected represent the population. Purposive sampling is appropriate to select unique cases that are especially informative.

For example, a researcher wants to study the temperamental attributes of certain problem behaviour children. It is very difficult to list all certain problem behaviour children and sample randomly from the list. The researcher uses many different

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methods to identify these cases and approach them to obtain the relevant information. The primary consideration in purposes sampling is the judgment of researcher as to who can provide the best information to achieve the objectives of the study. The researcher only goes to those people who in his / her opinion are likely to have the required information and be willing to share it.

For studying attitude toward any national issue, a sample of journalists, teacher and legislators may be taken as an example of purposive sampling because they can more reasonably be expected to represent the correct attitude than other class of people residing in country.

Purposes sampling is somewhat less costly, more readily accessible, more convenient and select only those individual that are relevant to research design.

Despite these advantages of purposes sampling, there is no way to ensure that the sample is truly represent of the population and more emphasis is placed on the ability of researcher to assess the elements of population.

iv) **Snowball sampling**

Snowball sampling is also known as network, chain referral or reputation sampling method. Snowball sampling which is a non probability sampling method is basically sociometric. It begins by the collection of data on one or more contacts usually known to the person collecting the data. At the end of the data collection process (e.g., questionnaire, survey, or interview), the data collector asks the respondent to provide contact information for other potential respondents. These potential respondents are contacted and provide more contacts. Snowball sampling is most useful when there are very few methods to secure a list of the population or when the population is unknowable.

Snowball sampling has some advantages— 1) Snowball sampling, which is primarily a sociometric sampling technique, has proved very important and is helpful in studying small informal social group and its impact upon formal organisational structure, 2) Snowball sampling reveals communication pattern in community organisation concepts like community power; and decision-making can also be studied with the help of such sampling technique.

Snowball sampling has some limitations also— 1) Snowball sampling becomes cumbersome and difficult when is large or say it exceeds 100, 2) This method of sampling does not allow the researcher to use probability statistical methods. In fact, the elements included in sample are not randomly drawn and they are dependent on the subjective choices of the originally selected respondents. This introduces some bias in the sampling.

v) **Systematic sampling**

Systematic sampling is another method of non-probability sampling plan, though the label 'systematic' is somewhat misleading in the sense that all probability sampling methods are also systematic sampling methods. Due to this, it often sounds that systematic sampling should be included under one category of probability sampling, but in reality this is not the case.

Systematic sampling may be defined as drawing or selecting every ninth person from a predetermined list of elements or individuals. Selecting every 5th roll

number in a class of 60 students will constitute systematic sampling. Likewise, drawing every 8th name from a telephone directory is an example of systematic sampling. If we pay attention to systematic sampling plan, it become obvious that such a plan possesses certain characteristics of randomness (first element selected is a random one) and at the same time, possesses some non-probability traits such as excluding all persons between every ninth element chosen.

Systematic sampling is relatively quick method of obtaining a sample of elements and it is very easy to check whether every ninth number or name has been selected. Further Systematic sampling is easy to used.

Despite these advantages, systematic sampling ignores all persons between every ninth element chosen. Then it is not a probability sampling plan. In Systematic sampling there is a chance to happen the sampling error if the list is arranged in a particular order.

Activity

Make a list of some research studies where some of the non probability methods could be used. Also justify the choice of particular sampling method you have selected for the study.

4.9.2 Probability Sampling

Probability sampling methods are those that clearly specify the probability or likelihood of inclusion of each element or individual in the sample. Probability sampling is free of bias in selecting sample units. They help in estimation of sampling errors and evaluate sample results in terms of their precision, accuracy and efficiency and hence, the conclusions reached from such samples are worth generalisation and comparable to similar population to which they belong. Major probability sampling methods are:

i) Simple random sampling

A simple random sample is a probability sample. A simple random sample requires (a) a complete listing of all the elements (b) an equal chance for each elements to be selected (c) a selection process whereby the selection of one element has no effect on the chance of selecting another element. For example, if we are to select a sample of 10 students from the seventh grade consisting of 40 students, we can write the names (or roll number) of each of the 40 students on separate slips of paper – all equal in size and colour – and fold them in a similar way. Subsequently, they may be placed in a box and reshuffled thoroughly.

A blindfolded person, then, may be asked to pick up one slip. Here, the probability of each slip being selected is $1/40$. Suppose that after selecting the slip and noting the name written on the slip, he again returns it to the box. In this case, the probability of the second slip being selected is again $1/40$. But if he does not return the first slip to the box, the probability of the second slip becomes $1/39$. When an element of the population is returned to the population after being selected, it is called sampling with replacement and when it is not returned, it is called sampling without replacement.

Thus random sampling may be defined as one in which all possible combinations of samples of fixed size have an equal probability of being selected.

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Advantages of simple random sampling are:

- 1) Each person has equal chance as any other of being selected in the sample.
- 2) Simple random sampling serves as a foundation against which other methods are sometimes evaluated.
- 3) It is most suitable where population is relatively small and where sampling frame is complete and up-to-date.
- 4) As the sample size increases, it becomes more representative of universe.
- 5) This method is least costly and easily assessable of accuracy.

Despite these advantages, some of the disadvantages are:

- 1) Complete and up-to-date catalogued universe is necessary.
- 2) Large sample size is required to establish the reliability.
- 3) When the geographical dispersion is so wider therefore study of sample item has larger cost and greater time.
- 4) Unskilled and untrained investigator may cause wrong results.

Activity

In a class of 140 students, select a simple random sample of size 20 students with replacement technique. Also mention the probability of each one of 140 students being included in the sample.

ii) **Stratified random sampling**

In stratified random sampling the population is divided into two or more strata, which may be based upon a single criterion such as sex, yielding two strata-male and female, or upon a combination of two or more criteria such as sex and graduation, yielding four strata, namely, male undergraduates, male graduates, female undergraduates and female graduates. These divided populations are called subpopulations, which are non-overlapping and together constitute the whole population.

Having divided the population into two or more strata, which are considered to be homogeneous internally, a simple random sample for the desired number is taken from each population stratum. Thus, in stratified random sampling the stratification of population is the first requirement.

There can be many reasons for stratification in a population.

Two of them are:

- 1) Stratification tends to increase the precision in estimating the attributes of the whole population.
- 2) Stratification gives some convenience in sampling. When the population is divided into several units, a person or group of person may be deputed to supervise the sampling survey in each unit.

Advantages of stratified Random Sampling are:

- 1) Stratified sampling is more representative of the population because formation of stratum and random selection of item from each stratum make it hard to exclude in strata of the universe and increases the sample's representation to the population or universe.

- 2) It is more precise and avoids the bias to great extent.
- 3) It saves time and cost of data collection since the sample size can be less in the method.

Despite these advantages, some of the disadvantages of stratified sampling are:

- 1) Improper stratification may cause wrong results.
- 2) Greater geographical concentration may result in heavy cost and more time.
- 3) Trained investigators are required for stratification.

iii) Cluster sampling

A type of random sample that uses multiple stages and is often used to cover wide geographic areas in which aggregated units are randomly selected and then sample are drawn from the sampled aggregated units or cluster

For example, if the investigator wanted to survey some aspect of 3rd grade elementary school going children. First, a random sample of number of states from the country would be selected. Next, within each selected state, a random selection of certain number of districts would be made. Then within district a random selection of certain number of elementary schools would be made. Finally within each elementary school, a certain number of children would be randomly selected. Because each level is randomly sampled, the final sample becomes random. However, selection of samples is done to different stages. This is also called multi stage sampling.

This sampling method is more flexible than the other methods. Sub-divisions at the second stage unit needs be carried out only those unit selected in the first stage. Despite these merits, this sampling method is less accurate than a sample, containing the same number of the units in single stage samples.

Self Assessment Questions

- 1) Non probability sampling is one which there is way of assessing the probability of the element or group of element of population, being included in the sample. T/F
- 2) Simple random sampling is the core technique and attaches equal probability to each unit of the population to be selected. T/F
- 3) Cluster sampling method sometimes known as multi stage sampling method. T/F
- 4) Snowball technique is a probability sampling method. T/F
- 5) Stratified sampling is more representative for the population than other methods. T/F

Answer: (1) F, (2) T, (3) T, (4) F, (5) T.

4.10 IMPORTANCE OF SAMPLING

In research, sampling method has obtained great importance. Sampling studies are becoming more and more popular in all type of studies. The vastness of the population, the difficulties of contacting people, high refusal rate, difficulties of ascertaining the universe make sampling the best alternative in case of social studies. The census method is rarely, if ever tried in matters of social research.

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Recent developments in sampling technique have made this method more reliable and valid. The results of sampling have attained a sufficiently high standard of accuracy.

The three main advantage of sampling are that cost is lowest, data collection is faster, and since the data set is smaller, it is possible to ensure homogeneity and to improve the accuracy and quality of data (Ader, Mellenbergh & Hard (2008)

4.11 LET US SUM UP

In this unit you have learnt about hypothesis formulation and sampling. A hypothesis is a speculative statement that is subjected to verification through a research study. In formulating a hypothesis it is important to ensure that it is simple, specific and conceptually clear; is able to be verified; is rooted in an existing body of knowledge; and able to be operationalized. There are two broad types of hypothesis: a null hypothesis and an alternate hypothesis.

Sampling is the act, process, or technique of selection a suitable sample, or a representative part of a population for the purpose of determining parameters or characteristics of the whole population.

Researchers rarely survey the entire population for two reasons: The cost is too high, and the population is dynamic in that the individual making up the population may change over time. Sampling methods are of two types i.e. Non probability and probability sampling methods. Probability sampling methods are those in which some probability to each unit of the population to be included in the sample and this is more representative. Three different probability sampling method are discussed as simple random sampling, stratified random sampling and cluster / multi stage sampling. The other non probability sampling methods discussed are convenience sampling, Quota sampling, Purposive sampling, Snowball sampling and systematic sampling. These methods are also used but lack the representative character of samples.

4.12 UNIT END QUESTIONS

- 1) Define hypothesis and explain its characteristics.
- 2) Write short notes on:
 - a) Formulation of hypothesis
 - b) Null hypothesis
 - c) Alternative hypothesis
- 3) Write a hypothesis which incorporates each pair of concepts listed below:
 - a) academic achievement and teaching methods
 - b) education and social prestige
 - c) frustration and need for achievement
- 4) What is sampling? Discuss its importance.
- 5) What is simple random sampling. Discuss its advantages and disadvantages.
- 6) What do you mean by probability sampling method. Discuss any two types of probability sampling methods.

7) Define the following:

- 1) Sampling unit
- 2) Population
- 3) Sampling frame

4.13 GLOSSARY

Hypothesis	:	A tentative and testable statement of a potential relationship between two or more variables.
Null hypothesis	:	The hypothesis that is of no scientific interest; sometimes the hypothesis of no difference.
Alternative hypothesis	:	Statistical term for research hypothesis that specifies values that researcher believes to hold true.
Population	:	It is the aggregate from which a sample is drawn. In statistics, it refers to any specified collection of objects, people, organisation etc.
Population size	:	It is the total number of units present in the population.
Sampling units	:	They are members of the population.
Sampling frame	:	It is the list of all the units of population.
Sampling design	:	It is a definite plan for obtaining a sample from a given population.
Sample size	:	It is the total number of units in the sample.
Simple random sample	:	It is a sample in which each unit of the population has an equal chance of being selected in the sample.

4.14 SUGGESTED READINGS AND REFERENCES

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UNIT 1 SURVEY RESEARCH

Structure

- 1.0 Introduction
- 1.1 Objectives
- 1.2 Concept and Meaning of ‘Survey Research’
- 1.3 Steps Involved in Conducting Survey Research
- 1.4 Methods/ Instruments Used in Collecting Data Through Survey Research
- 1.5 Types of Survey Research
- 1.6 Constructing a Survey Research
- 1.7 Types of Questions in a Survey Research
 - 1.7.1 Structured Questions
 - 1.7.2 Unstructured Questions
- 1.8 Precautions while Designing Instruments
- 1.9 Advantages and Disadvantages of Survey Research
- 1.10 Difficulties and Issues of Survey Research
- 1.11 Let Us Sum Up
- 1.12 Unit End Questions
- 1.13 Suggested Readings and References

1.0 INTRODUCTION

One of the most important areas of research tools in the field of applied social science is the ‘survey research’. It is one of the most relevant techniques basically used for collecting data and involves any measurement procedures that prominently include asking questions from respondents or the subjects selected for the research study. The term “survey” can be defined as a process which may involve an investigation/ examination or assessment in the form of a short paper-and-pencil feedback form to an intensive one-on-one in-depth interview. With the help of the questionnaire or other statistical tools, the method tries to gather data about people, their thoughts and behaviours. This unit tries to focus on the concept, various methods, the relevance and implications of the survey research method.

1.1 OBJECTIVES

After completing this unit, you will be able to:

- Define and describe the survey research method;
- List out the different methods or techniques of the survey research method;
- Elucidate the different types of survey research;
- Analyse the advantages and disadvantages of the survey research method; and
- Describe the kind of questions that should be used in survey.

1.2 CONCEPT AND MEANING OF ‘SURVEY RESEARCH’

The method of survey research is a non-experimental (that is, it does not involve any observation under controlled conditions), descriptive research method which is one of the quantitative methods used for studying of large sample. In a survey research, the researcher collects data with the help of standardised questionnaires or interviews which is administered on a sample of respondents from a population (population is sometimes referred to as the universe of a study which can be defined as a collection of people or object which possesses at least one common characteristic). The method of survey research is one of the techniques of applied social research which can be helpful in collection of data both through direct (such as a direct face to face interview) and indirect observation (such as opinions on library services of an institute).

1.3 STEPS INVOLVED IN CONDUCTING SURVEY RESEARCH

Any type of survey research follows the following systematic steps:

Step 1: Determination of the aims and objectives of study:

The researcher must at the outset analyse and assess the relevant areas or issues which need to be studied. Once the research area is selected by the researcher, the basic aims and objectives have to be clearly specified. These have to be focused and analysed so as to make the purpose of research relevant and understandable. The researchers have to come up with the basic aims and objectives which would be focused and analysed in their overall research.

Step 2: Define the population to be studied:

After selecting the theme of the research, the researcher also needs to define the target population which would be studied by him/her. As discussed earlier, the population or universe would be a collection of people or object that would possess at least one common characteristic, which is going to be helpful and which would also provide direction in the process of conducting the research.

Step 3: Design and construct a survey:

Once the target population is defined by the researcher, he or she needs to design a survey research. On the basis of the framed design, the researcher decides to conduct a survey, selects instrument for survey (for example telephonic interview) with the help of which data will be collected. After the selection of the instrument, the researcher conducts a pilot study (a small survey taken in advance of a major investigation or research). The pilot study helps the researcher to analyse the significance and relevance of the instruments selected by the researcher for the present research.

Step 3: Select a representative sample:

The process of construction of the survey instruments gives a way to the selection of the sample from the target population. The researcher selects a sample which represents nearly maximum characteristics of the whole universe/ population. If the sample selected is a good representation of the population, then the results or

the findings of the survey conducted on the sample can be easily generalised on the population as a whole.

Step 4: Administer the survey:

After the selection of the sample, the researcher conducts the survey by administering the survey instrument or tool on the selected sample. This step helps in the collection of the required data or information from the sample.

Step 5: Analyse and interpret the findings of the survey:

Once the data has been collected, the researcher analyses the data with the help of required statistical tools and then interprets the findings on the basis of the information revealed. This step involves several processes such as coding the data and then processing it.

Step 6: Prepare the report of the survey:

On the basis of the analysis and interpretation of the results, the researcher prepares a report of the over all research conducted. The report contains all the details of aims, objectives, data analysis, interpretation and discussion of the results. In this step, the researcher tries to evaluate how the findings meet the proposed aims and objectives of the research.

Step 7: Communicate the findings of the survey:

Last but not the least, the most important step of conducting the survey research is to disseminate the survey findings. The researcher needs to communicate the findings to the target population and it is equally important record for the future research to be done on a similar field. The impacts of the survey results are also assessed on them, on the basis of which the researcher may also recommend certain policies on decision making.

Self Assessment Questions

Fill in the blanks

- 1) In a survey research, the researcher collects data with help of
- 2) On the basis of the analysis and interpretation of the results, the researcher prepares of the over all research conducted
- 3) The population or universe can be defined as
- 4) Pilot study can be defined as
- 5) Discuss the steps involved in survey research

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1.4 METHODS/INSTRUMENTS USED IN COLLECTING DATA THROUGH SURVEY RESEARCH

It has been argued that surveys should be designed in such a way that helps in making accurate decisions. Predominantly there are three major ways which can be used as an instrument in collecting data with the help of survey research. They are being explained below:

- 1) **Sampling:** As discussed earlier, a sample is a representation of the population or universe selected for the study. The technique of sampling can in itself act as an instrument in collecting data in survey research. For example if the researcher wants to study the level of job satisfaction amongst the employees of an organisation, then the researcher can select and study the attitude of at least ten persons of each department of the organisation. In order to avoid any bias, the sampling can be done with the help of randomisation (a method of sampling which provides an equal chance for each subject to be involved in the study, which can be done with the help of lottery or fish bowl technique) or stratification (a method of sampling which categorizes the population in to various categories and subcategories and then conducting the research).
- 2) **Questionnaire:** Questionnaires are basically a kind of paper pencil and multiple choice test in which the individual needs to select the most suitable alternative. The researcher may collect data with the help of a questionnaire from a large number of samples at a single time. Questionnaires can be administered to the sample in three ways: (i) Mail survey (ii) Group administered questionnaire and (iii) household drop off survey. These are being discussed in detail below:
 - i) *Mail survey:* The researcher may forward a soft copy of the questionnaire to a large number of respondents through mail and can get the data collected from them at a single time. It is one of the relatively inexpensive, less time consuming and convenient method of getting responses. Yet, the questions which require on the spot response or detailed answer is difficult to be achieved through mail survey.
 - ii) *Group administered questionnaire:* It is one of the traditional methods of administering questionnaire. The researcher calls for a large number of respondents to be present at a stipulated time period as a group. Under such group settings, the respondents are asked to respond to a structured sequence of questions written in paper or questionnaire. The greatest advantage of this method is that the respondents can clarify their doubt regarding any questioned that has been asked by the researcher instantly.
 - iii) *Household drop-off survey:* In this method, the researcher goes door to door to the respondents and personally hands over as well as collects the questionnaire from them. It is a kind of pick and drop facility which is provided by the researcher so that the researcher can answer the questions according to their convenience.
- 3) **Interview:** Interview is a kind of face to face interaction which helps in providing more honest answers and responses from the sample, as the

interviewer (the one who is interviewing i.e., the researcher) works directly with the respondent or the interviewee (the one who is being interviewed). Unlike questionnaires, the interviewer has an opportunity to ask follow-up questions. They are the best suitable methods for those questions which require opinions or impressions from the respondents. Interviews can be of different types as given below:

- i) *Structured interview*: Structured interviews are those interviews in which the questions that are to be asked from the respondents are prepared and preplanned in advance by the researcher. The researcher imposes those prepared questions on the respondents serially and notes down the answers given by them.
- ii) *Unstructured interview*: Interviews are said to be unstructured when the researcher conducts an interaction with the respondent in an informal atmosphere. Nothing is preplanned in advance. The response of the sample gives a clue to the researcher to ask the next question.
- iii) *Telephonic interview*: In order to save time and money, the researcher may call the subjects or sample through telephone and ask them questions to collect data. This method helps in saving time and energy but the sample gets limited to only that part of the population who have the facility of telephones at their residences or offices.

1.5 TYPES OF SURVEY RESEARCH

Based on the selection of an instrument or method of data collection, the researcher can use qualitative (e.g. ask open-ended questions) or quantitative (e.g. use forced-choice questions) measures. Basically there are two major types of survey: cross-sectional surveys and longitudinal surveys, though there exist some other types of surveys also. These are explained below:

Cross sectional survey

Cross sectional surveys are used by the researcher when he or she wants to collect data from varied or different types of groups (that may be in terms of age, sex, group, nation, tribes and so on) at a single time. An example of such a survey can be a study on the effect of socialisation of children of different age groups of a particular country. This type of survey is less time consuming and economical as well.

Longitudinal survey

This type of research is used only when the subject wants to study the same sample for a longer period of time. Such longitudinal studies may be used to study behavioural changes, attitude changes, religious effects or any event or practice that may have a long time effect on the selected sample or population. There are three main types of longitudinal studies which help the researcher to analyse the long term effects on the selected sample. These three include (i) Trend studies (ii) Cohort studies and (iii) Panel studies. These are explained in the following paragraphs.

i) *Trend studies*

When the researcher needs to analyse a trend of a phenomenon in a population, they conduct trend studies. The sample of the selected population might not be the same (as over a period of time they might have shifted or not available for various reasons) but they belong to the same population. This selected population is sampled and examined regularly. Since it is a type of longitudinal research, it may not be started as well as ended by just one researcher or research project. An example of trend studies may be a yearly survey of number of graduates actively using books and journals from the library of a university.

ii) *Cohort studies*

The focus of this type of longitudinal study is also on a particular population which is sampled and studied more than once within a time gap. The example of this study can be an investigation of the number of graduates of the year 2009 who have been actively using the library and four years later, the researcher may examine the same issue on another sample of the 2009 graduates and investigate whether after the time gap has there been any difference in the attitudes towards the importance of the library within the members of the same class. Wherein, in the trend study, the research scholar would study such an attitude within the graduates of different batches of the same university.

iii) *Panel studies*

The researcher in a panel study uses the same sample of people every time and that sample is called as a 'panel'. Such a study is used in order to investigate the changes in attitudes, behaviour or practices of the same panel within a period of time. They are more specific and focused as the researcher studies a particular change in the attitude, behaviour, belief or practice of the same group. For example, a researcher may study the library usage trends amongst the graduate students and ask them questions related to their frequency of library usage habits. Thereafter, the researcher may ask the same group or panel, similar questions and also the reasons behind the changes in their habits, if it has occurred. The study is difficult enough as it faces a greater trend of attrition rates (difficulty in availability of the same people).

Self Assessment Questions

State whether the following are true or false

- 1) The panel study is used in order to investigate the changes in attitudes, behaviour or practices of the same sample within a period of time. ()
- 2) There are different types of longitudinal studies. ()
- 3) Interviews are said to be unstructured when the researcher asks preplanned questions ()
- 4) A sample can never be a representation of the population. ()

1.6 CONSTRUCTING A SURVEY RESEARCH

In the process of conducting a survey research, the researcher needs to design a framework of the instruments and processes of data collection, on the basis of

which the overall research would be done. The researcher needs to decide the content, format and wordings that would be included in the survey instruments. No doubt the researcher selects any one of the kinds of instruments (that is questionnaire/ interview), he or she needs to frame questions. The questions should be so worded that there is clarity in what is being asked and should have the capability of eliciting response.

The survey instruments are the back bone of research and that is why the statements or the questions of the researcher should be short and specific as well. Once the framework of the process of research is decided, then the researcher constructs the survey instrument by framing questions. While writing the questions for the survey, the researcher needs to take care of a few basic aspects, given below:

- Deciding the content, scope and objectives of the question.
- Selecting the most convenient format of response (for example- Likert type five point scale/ multiple choice questions and so on).
- Deciding on how to frame the questions that would elicit the required response.
- Formatting the series of questions to bring out the best response and favorable conditions for the survey.
- The researcher needs to be very sensitive while preparing the questions and take full care of the moral values and ethics of the respondents to get the best results.

1.7 TYPES OF QUESTIONS IN A SURVEY RESEARCH

As discussed earlier, the researcher needs to be very careful while preparing or constructing the questions of a survey research. Selection of the type of questions is a very crucial aspect, as the whole research would depend upon such questions. Broadly survey questions can be divided as structured and unstructured questions. Each one of them is explained below:

1.7.1 Structured Questions

Structured questions are those questions, the format of which is preplanned and predefined in advance. Some of the types of structured questions include (i) Dichotomous Questions. (ii) Level of measurement based questions (iii) Filter or Contingency Questions

i) *Dichotomous questions*

A question is said to be dichotomous if it has only two possible responses (for example – yes or no/ true or false and so on). The lay out of these questions appear in the following ways in the questionnaire:

Does the library of your university has an electronic data base system?

_____Yes

_____No

OR

Please mention your gender:

Male ☐ Female ☐ii) *Level of measurement based questions*

Not to be mentioned that three basic levels of measurement are: nominal (based on names, classification of persons, objects and groups), ordinal (based on ranks and preferences) and interval (based on ratings) measurements. For example, a nominal question may have numbers before each response, which may only represent the serial order, like –

Please state the category to which you belong:

General- _____

OBC- _____

SC/ST- _____

The numbers here just denote the serial order and have nothing to do with the preference or ranks.

A question based on the ordinal level of measurement will be based on the preference or choice of the respondent. For example, the respondent may be asked to give a ranking for the business tycoons in an order of most trendy or fashionable to least trendy, where the respondent may be asked to give a rank of 1 to the most trendy tycoon and 4 to the least trendy tycoon:

_____ Subroto Roy

_____ Mukesh Ambani

_____ Bill Gates

_____ Vijay Mallya

The respondent may rank the tycoons on the basis of their own likings and preferences.

The question based on interval scale may be based on rating the choices, out of which the most commonly used scale is Likert response scale (which has a rating of 1 to 5, or 1 to 7, or, 1 to 9). For example:

The university has a well equipped and fully furnished library:

1	2	3	4	5
Strongly agree	Agree	Can not say	Disagree	Strongly disagree

iii) *Filter or Contingency Questions*

When a question is framed in such a way that it is followed by succeeding questions, which are sub parts of the main question, such types of question design is known as filter or contingency questions.

For example, if a researcher wants to ask whether the respondent has ever attended the library of the university and if the researcher also wants to know how many times the respondent has attended the library, then the format of the question will be as follows:

Have you ever regularly attended the library of your university?

Yes ☐

No ☐

If yes, then how many times?

Once in a month ☐

Twice in a month ☐

Every week of the month ☐

Each and every day in a month ☐

The researcher may use multiple filter questions in order to get the subsequent responses. But he or she should take full care that in order to maintain the interest of the respondent, they should not exceed more than two to three levels for any question.

1.7.2 Unstructured Questions

Unstructured questions are usually used in interview, where either the researcher does not prepare a list of questions and the series of questions might depend upon the response of the subjects or they ask questions in an informal atmosphere. In order to get adequate and required information, the researcher should take full care and should give a silent probe, verbally encourage, ask for clarification and have full empathy with the respondent.

Self Assessment Questions

Choose the correct alternative

- 1) A question is said to be dichotomous one if,
 - a) it has more than two responses
 - b) it has two responses
 - c) It has a single response
 - d) none of the above
- 2) In the process of conducting a survey research, the researcher needs to design
 - a) framework of the instruments and processes of data collection
 - b) the framework of the administrative requirements
 - c) the framework of the personality requirements
 - d) none of the above
- 3) A question based on the ordinal level of measurement will be based on
 - a) the preference or choice of the respondent
 - b) the ratings of the respondent
 - c) the classification of the respondent
 - d) none of the above

1.8 PRECAUTIONS WHILE DESIGNING INSTRUMENTS

While preparing the questionnaire or the survey instrument, the researcher should take full care of the following aspects:

- 1) The items or the questions of the instruments should be clear , specific, relevant and short.
- 2) The respondents of the research should also be capable enough to answer the questions
- 3) The researcher should have full empathy with the respondents and should avoid those questions which might have a negative impact on the respondent.
- 4) The researcher should also avoid any kind of bias either towards the questions or towards the respondents of the questions.

1.9 ADVANTAGES AND DISADVANTAGES OF SURVEY RESEARCH

Survey research has the following advantages:

- It is convenient, less time taking and economical for the researcher.
- The survey can be conducted for a longer period of time, which gives a chance of knowing about the latest changes or advancements that might have taken place in the agenda under study
- The researcher gets a full chance to well organise and present the reasons of the study to get full and honest answers from the respondents.
- Yet, the method of survey research lacks the following aspects.

Disadvantages

- Maintaining the privacy of responses of each respondent under a group interview is questionable and that may also restrict full and honest answers from them.
- High attrition rate of the respondents might hinder the longitudinal based studies.

1.10 DIFFICULTIES AND ISSUES OF SURVEY RESEARCH

If the researcher plans to go for a survey research, there are certain issues which he or she might have to understand and take full care. They are:

1) Issues on selecting the type of survey

One of the most critical decisions for a researcher is to select the kind of survey that might be most appropriate or suitable for his or her study. The researcher should be aware of the kind of population that would be suitable for the study. Again, they should also be comfortable with the language of the selected population. The researcher should also analyse the geographic restrictions and try to find out which method can be most feasible for a dispersed population.

2) Issues on survey instruments

While constructing the survey, the researcher should have full knowledge of the suitability of the questions that would be asked to the respondents. The type of questions, clarity and specificity of the questions as well as the length of the questions are some of the controversial issues within a survey research.

3) Bias Issues

The researcher's bias and prejudices might have a significant influence on the findings of the survey research, so they should be fully aware of the repercussions of their bias. Their behaviour should be socially desired ones, he or she should not lose track and also should avoid false reports. In such cases, issues of bias is really difficult but essential agenda in a survey research.

4) Administrative Issues

The cost, mode of survey, feasibility of the area selected, required time period are also important aspects which needs to be preplanned even before the advancement of the research.

Self Assessment Questions

Fill in the blanks

- 1) The researchers' biasness and prejudices might have a significant influence on the of the survey research.
- 2) High attrition rate of the respondents might the longitudinal based studies.
- 3) The researcher should have full empathy with the
- 4) The basic administrative issues are

1.11 LET US SUM UP

In this unit we learnt that the method of survey research holds a significant position in the area of the applied research. We also learnt the steps involved in conducting survey research. We then learnt about the types of survey research and explained each of them in detail. We learnt how to construct a survey research and what are the ways in which questions should be asked in a survey and how to avoid biases. We dealt with the many precautions while designing instruments and learnt about the advantages and disadvantages of the survey research. The methods and kinds of survey research that are most common and are frequently used by a number of research scholars were also mentioned. Yet it was pointed out that there are certain aspects which are crucial enough and the researcher should take full care. The process of constructing of the survey research is also very significant and important decision that determines the extent to which the research would be successful.

1.12 UNIT END QUESTIONS

- 1) Describe the different methods or techniques of the survey research method.
- 2) Explain the different types of conducting survey research.

- 3) Explain the different issues of survey research method
- 4) What are the different types of questions that can be designed for a survey instrument?
- 5) Explain the different types of interviews that can be used for conducting a survey research

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UNIT 2 EX-POST FACTO RESEARCH

Structure

- 2.0 Introduction
- 2.1 Objectives
- 2.2 Forms of Research Design
- 2.3 Concept and Meaning of Ex-post Facto Research
- 2.4 Characteristics of Ex-post Facto Research
- 2.5 Differences between an Experimental and an Ex-post Facto Research
- 2.6 Essentials/Requisites for Inferring Causal Relationships
- 2.7 Steps of Ex-post Facto Research
- 2.8 Strengths and Weaknesses of Ex-post Facto Research
- 2.9 Concept of Post Hoc Fallacy
- 2.10 Let Us Sum Up
- 2.11 Unit End Questions
- 2.12 Suggested Readings and References

2.0 INTRODUCTION

The present unit will focus on the concept, meaning, significance and types of ex-post facto research. Research can be briefly explained as an objective based, specific and the systematic process of exploring new knowledge, skills, behaviour, attitudes and values as well as practices, or for the re-interpretation of existing knowledge, behaviour, skills, attitudes and values. Based on the research goal or problem, the selection of research method by the researcher may vary. When the researcher wants to study the cause of an event which has already occurred as an effect of the cause, then the research conducted is known as 'ex post facto' research. For example, if there has been an economical recession in a country and the researcher tries to analyse the 'cause' or reason behind such recession (which is the 'effect'). In this unit you will be learning all about the ex-post facto research, its meaning and characteristic features etc. You will also learn about the differences between ex-post factor and experimental research and how to infer causal relationships. We also will learn about the strengths and weaknesses of this type of research.

2.1 OBJECTIVES

After completing this unit, you will be able to:

- Define ex-post facto research;
- Explain the characteristics of the ex-post facto research;
- Differentiate between experimental and ex-post facto research;
- Elucidate the sequence or steps of the ex-post facto research; and
- Explain the strengths and weaknesses of the ex-post facto research.

2.2 FORMS OF RESEARCH DESIGN

On basis of the occurring events, there can be two designs or forms of research and these are Prospective research design and Retrospective research design. When the researcher tries to find out the future or potential results that is, the effect after treating the independent variable or the cause, then the researcher is actually trying to examine the prospective or the future results. For example, if the researcher wants to examine the effects of excess of smoking, then the subject may be asked to smoke under varied conditions which may result in cancer.

The Retrospective research design on the other hand is one in which the researcher tries to trace the history in order to find out the basic reason behind an event. Here a result has already occurred, and the researcher is trying to find out the causes behind its occurrence by going backwards in history. This kind of results obtained are said to be based on retrospective research design. For example, if the researcher wants to examine the reason behind the occurrence of cancer in a person, then they may try to trace the possible reasons that might have led to cancer. The possibilities may be excess of smoking/ heredity/ diet habits and so on.

Self Assessment Questions

State whether the following statements are True or False

- 1) In a prospective research design, the researcher tries to trace the history of an already occurred event ()
- 2) When the researcher wants to study the cause of an event then the research conducted is known as 'ex post facto' research ()
- 3) When the researcher tries to find out the future or potential results after manipulating the independent variables, then the researcher is actually trying to examine the retrospective aspects of the research. ()

2.3 CONCEPT AND MEANING OF EX-POST FACTO RESEARCH

The ex-post facto research is a kind of research in which the researcher predicts the possible causes behind an effect that has already occurred. For example, if a child is delinquent (that is, one who indulges in criminal activities), then in order to find the basic reason behind such delinquency, the researcher would try to find out the various events that have occurred and the many possibilities that could have contributed to the concerned delinquent behaviour. The expected possibilities may be lack of discipline at school/ family history/ peer effect/ neighbourhood or socialisation.

It is an interesting point to note that, the researcher predicts a cause on the basis of a controlled effect (since no variation can be done on the effect which has already taken place on the basis of the independent variable or the cause).

Thus, an ex-post facto research can be defined as an empirically based investigation which does not involve the researchers' direct control over the

independent variables because they have already led to effects which can no more be manipulated. The conclusions regarding the relationship between the variables are inferred without intervening or varying the independent or dependent variable.

The term ex-post facto according to Landman (1988: 62) is used to refer to an experiment in which a researcher, instead of finding a treatment, examines the effect of a naturally occurring treatment after it has occurred. In other words it is a study that attempts to discover the pre-existing causal conditions between groups.

It should, however, be pointed out that the most serious danger of ex-post facto-research is the conclusion that because two factors go together, one is the cause and the other is the effect.

2.4 CHARACTERISTICS OF EX POST FACTO RESEARCH

Based on the concept of the ex-post factor research, it is also known as 'causal comparative research'. The ex-post facto research has certain characteristic which distinguishes it from other different types of researches. Some of these characteristics are presented below in the following paragraphs.

The research has a control or a comparison group

As the research is done on basis of the study of the cause which has already led to its effects, it becomes necessary for the researcher to keep a control group, which can be used for comparison with the actual experimental group later on, in order to analyse the cause of an already occurred event.

The behaviour, action, event or the treatment or the independent variable of the research cannot be manipulated or changed

As the ex-post research is a kind of study which tries to predict the causes on the basis of actions that have already occurred, the researcher cannot manipulate or change the already occurred actions or behaviour.

The research focuses on the effects

Since the researcher tries to analyse and predict the reasons behind the occurrence of an event or phenomena, their first attempt is to focus on the event or the phenomena that has already occurred. Only after having a detailed study of the phenomena or the event, the researcher tries to determine the causes behind such an event or phenomena.

The research tries to analyse the 'how' and 'what' aspect of an event

Since the researcher tries to understand the causal effects behind a phenomena, the research basically focuses on how and what reasons that has led that phenomena to occur.

Explores possible effects and causes

With the help of an ex-post facto research, the researcher tries to analyse the cause and effect phenomena of an event, action or behaviour.

2.5 DIFFERENCES BETWEEN AN EXPERIMENTAL EX-POST FACTO RESEARCH

There is no doubt that both the experimental research and the ex-post facto research try to investigate relationships between the existing variables, the conclusions of both are logically as well as empirically valid and reliable, yet there are certain basic differences between both of them. They can be pointed out as follows:

	Experimental research	Ex-post facto research
Control over independent Variable	In an experimental research, the researcher can directly manipulate the independent variable/s (that is, the cause) in order to examine its effect on the dependent variable (that is, the effect).	In an ex-post facto research, the researcher can not directly manipulate the independent variable/s (that is, the cause) as he or she predicts the cause on basis of the dependent variable (that is, the effect).
Principle of randomisation	The researcher can use the principle of randomisation in an experimental research on basis of which they can conclude or infer that other things remaining equal/constant/controlled the effect is a result of manipulation of the cause.	The researcher can not use the principle of randomisation in an ex-post facto research as the researcher has no direct control over the cause and so they infer the possibilities of the causes on basis of the existing effect.
Manipulation of variables	The researcher can manipulate variables in an experimental research	The researcher can not manipulate variables in an ex-post facto research.
Interpretation	It is easier to interpret or infer relationships between the independent and dependent variables as they can manipulate the independent variable and see its effect on dependent variable	It is difficult to interpret or infer relationship between the independent and dependent variables as there can be more than one possibilities or cause for a particular effect.

Self Assessment Questions

Fill in the blanks:

- 1) The researcher can use the principle of randomisation in an research
- 2) The researcher can not manipulate variables in an research
- 3) The ex-post facto research can be defined as
- 4) The ex-post facto research is a kind of research in which the researcher predicts the possible behind an that has already occurred

2.6 ESSENTIALS/ REQUISITES FOR INFERRING CAUSAL RELATIONSHIPS

In order to infer or conclude the cause and effect relationships, the researcher needs to take care of the following aspects:

Associative variation

In order to infer/ predict or conclude that a particular effect 'y' is a result of a cause 'x', there should be an association between them. Therefore, the researcher can come to a conclusion only after examining that a variation in 'x' yields the effect 'y'.

Systematic order of events

The events or the process follows a consistent sequence or order. If variable 'x' causes 'y', then variable 'x' must occur before or simultaneously with 'y', and not after it.

Absence of other causes

The researcher should analyse each aspect of the causal relationship with full detail and find out the best possible cause/ reason or independent variable that has ultimately led to the effect /action or event to occur. For example, the etiology of cancer can be due to several factors. In an ex-post facto research, the researcher finds out the best possible reason that might have led to the occurrence of that disease within the person or the subject.

2.7 STEPS OF EX-POST FACTO RESEARCH

The process of ex-post facto research is systematic and follows a definite sequence. As mentioned by Isaac and Michael (1971), the following are the steps involved in the ex-post facto research—

Step 1. Determining the problem

In an ex-post facto research, it is necessary for the researcher to focus on the problem that he or she needs to study. They not only need to find out a problem, they also need to determine, analyse and define the problem which they will be dealing with.

Step 2. Literature Review

Before trying to predict the causal relationships, the researcher needs to study all the related or similar literature and relevant studies, which may help in further analysis, prediction and conclusion of the causal relationship between the variables under study.

Step 3. Formulation of hypothesis

The third step of the ex-post facto research is to propose the possible solutions or alternatives that might have led to the effect. They need to list out the assumptions which will be the basis of the hypothesis and procedure of the research.

Step 4. Designing the approach

Once the problem has been defined and the hypothesis has been postulated, the researcher needs to select the sample which fits the criteria of the study. They also need to select the scale or construct instrument for collecting the required information / data. Once the designing are all finalised, the researcher analyses the relationship between the variables.

Step 5. Validity of the research

The researcher needs to validate the significance of their research. They need to be cautious regarding the extent to which their findings would be valid and significant and helpful in interpreting and drawing inferences from the obtained results.

Step 6. Interpretation of the conclusion

Finally, the researcher needs to analyse, evaluate and interpret the information collected. It is on basis of this step only, the researcher selects the best possible alternative of causes which might have led the effect to occur.

Similarly, Jacobs et al. (1992: 81) also proposed that the following steps are involved in conducting an ex-post facto-research:

1st Step: The first step should be to state the problem.

2nd Step: Following this is the determination of the group to be investigated. Two groups of the population that differ with regard to the variable, should be selected in a proportional manner for the test sample.

3rd step: The next step refers to the process of collection of data. Techniques like questionnaires, interviews, literature search etc. are used to collect the relevant information.

4th Step: The last step is the interpretation of the findings and the results. Based on the conclusions the hypothesis is either accepted or rejected.

It must be remembered that even though the ex-post facto research is a valid method for collecting information regarding an event that had already occurred, this type of research has shortcomings, and that only partial control is possible.

2.8 STRENGTHS AND WEAKNESSES OF EX-POST FACTO RESEARCH

No research can be perfect in itself. All methods have their strengths as well as weaknesses. The same is applicable in the case of ex-post factor research too.

The *strengths* of the ex-post facto research are:

It is considered as a very relevant method in those behavioural researches where the variables can not be manipulated or altered.

The examples of such researches can include many sociological (e.g. delinquency) as well as educational variables (e.g. achievements).

It is more useful than an experimental research as it can be used in analysing a cause on basis of the effect, which is impossible in an experimental research.

It is less time consuming as well as economical.

It gives a chance to the researcher to analyse on basis of his personal opinion and then come out with the best possible conclusion.

The *weaknesses* as well as the *limitations* of the ex-post facto research are:

As discussed earlier, in an ex-post facto research, the researcher can not manipulate the independent variables.

The researcher can not randomly assign the subjects to different groups.

The researcher may not be able to provide a reasonable explanation for the relationship between the independent and dependent variables under study.

2.9 CONCEPT OF POST HOC FALLACY

While predicting the causal relationships between the variables, the researcher falls prey to the bias called the post hoc fallacy. The concept of post hoc fallacy says that, it is a tendency of human to arrive at conclusions or predictions when two factors go together, one is the cause and the other is the effect. Because delinquency and parenthood go together, we may come to a conclusion that delinquency is the effect and the parenthood is the cause, whereas in reality the peer group to which the child belongs may be the actual reason.

Self Assessment Questions

Fill in the blanks

- 1) The process of ex-post facto research is and follows a definite
- 2) Once the problem has been defined, the is postulated
- 3) Post hoc fallacy is a type of which might dominate the researchers' logical thought process

2.10 LET US SUM UP

It can therefore be concluded that the ex-post facto research holds a very good position in the field of behavioural sciences. It is the only method which is retrospective in nature, that is, with the help of this method one can trace the history in order to analyse the cause/ reason/action from an effect/behaviour/ event that has already occurred. Although it is a very significant method, yet it has certain limitations as well . The researcher can not manipulate the cause in order to see the alterations on its effect. This again marks a question on the validity of the findings of the research. Equally the researcher can not randomly assign the subjects in to groups and has no control over the variables.

Yet, it is one of the very useful methods as it has several implications in the field of applied research as well as behavioural sciences. The investigator can predict the relationship between the variables on basis of an already existing output or effect.

2.11 UNIT END QUESTIONS

- 1) Explain the concept and meaning of ex-post facto research.
- 2) Explain the characteristics of the ex-post facto research.
- 3) Differentiate between the concept of experimental and ex-post facto research.
- 4) Elaborate the sequence or steps of the ex-post facto research.
- 5) Explain the limitations and strengths of an ex-post facto research.

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UNIT 3 EXPERIMENTAL RESEARCH (FIELD EXPERIMENT)

Structure

- 3.0 Introduction
- 3.1 Objectives
- 3.2 Experimental Research and Field Experiments
 - 3.2.1 Identifying the Research Problem
 - 3.2.2 Experimental Research
 - 3.2.3 Field Experiment
- 3.3 Strengths and Weaknesses of Field Experiments
- 3.4 Constructing the Field Experiment
- 3.5 Research Design
- 3.6 Objectives of Research Design
- 3.7 Criteria for a Good Research Design
- 3.8 Types of Experimental Research Design
 - 3.8.1 Single Case Experimental Design
 - 3.8.2 Quasi-experimental Design
 - 3.8.3 Experimental Design
- 3.9 Let Us Sum Up
- 3.10 Unit End Questions
- 3.11 Suggested Readings and References
- 3.12 Answers to the Self Assessment Questions

3.0 INTRODUCTION

In the previous unit you have studied about the concept, meaning, characteristics, steps, strengths and weakness of Ex-post facto research. Now we are going to read about the experimental research and field research. Research can be classified into four major categories: (i) laboratory experiments, (ii) experiment research (field experiments), (iii) field studies and (iv) survey research. In this unit you will learn about experiments, types of experimental research design etc. You will also learn about the criteria of a good experimental design.

3.1 OBJECTIVES

After reading this unit, you will be able to:

- Define experimental research and field experiments;
- Describe the strength and weaknesses of field experiments;
- Define research design and its objectives;
- Explain criteria for a good research design;
- Explain types of experimental research design and its uses; and
- Elucidate the characteristics of a good research design.

3.2 EXPERIMENTAL RESEARCH AND FIELD EXPERIMENTS

Every research requires the identification of the problem which itself is an important step in any research work. In the following section we try to provide how a research problem is identified and what is research especially experimental research etc.

3.2.1 Identifying the Research Problem

The first step in any research is to define the research problem.

This helps the investigator to focus on a more narrow research area to be able to study it appropriately. Some time it is seen that the research problem is often operationalisation and hence it is imperative to define how to measure the research problem.

The results in such cases will depend on the exact measurements that the researcher chooses and may be operationalised to test the conclusions of the research problem. After defining the research problem the investigator must formulate hypothesis. This can be positive or negative or it can be null hypothesis for the research problem.

3.2.2 Experimental Research

Experimental research is mainly used in science subjects such as physics, chemistry, medicine, biology etc. Experiment requires two variables, one independent variable and the other dependent variable. It is important that in experimental research the independent variable is manipulated and the effect of manipulation is observed on the dependent variable. All other extraneous factors are completely controlled within the laboratory. It is based on research design which uses manipulation and controlled testing to understand the causal processes. Generally, we can manipulate one or more variables to determine their effect on a dependent variable. In other words it is a systematic and scientific approach to research in which the researcher manipulates one or more variables, and controls and measures the other variables.

3.2.3 Field Experiments

Field experiments on the other hand refer to experiments conducted in real life situations. Here the control of extraneous factors is not possible as it is a natural setting and there is no way to control any factor so absolutely as one does in the laboratory experiments. Hence in field experiments we take two groups matched for a number of factors such as age, sex, education, socio-economic status etc. Both these groups are in real life setting and thus are subjected to similar extraneous variables and thus the experimenter can observe the effects of his manipulation on one group and compare with the other group which is not subjected to any intervention. Take for example that the researcher wants to study the effects of different methods of teaching (e.g. lecture vs. tutorial). The school is the natural setting from where the researcher randomly selects 100 children from a particular standard (5th standard) and randomly assign them to two groups, viz., experimental (50 children) and control group (50 children). To the experimental group children the researcher uses the lecture method and to

the control group tutorial method. Then the effects of the academic performance of these children are compared before and after the introduction of the methods of teaching. If there is a difference in the academic performance of children in regard to the two methods of teaching, the experimenter can conclude that a particular method of teaching (e.g. tutorial) is more effective than the other method (lecture).

There are considerable differences between the experimental research and field experiments which are given in the table below:

Table 3.1: Differences between experimental research and field experiments

Experimental research	Field experiment
1) The subjects are homogeneous.	1) The subjects may vary in a number of characteristics.
2) The experimental subjects are in controlled conditions.	2) The subjects are not in controlled but in natural settings and conditions.
3) One experimental group is taken and subjected to the manipulation of the independent variable (Intervention) and see the effects of it on the subjects of the experimental group.	3) Two groups matched for certain basic characteristics which may confound the results are taken and one is subjected to intervention while the other is not. At the end the results of two groups on a dependent variable are compared to see the effect of intervention.
4) The cause effect relationship can be clearly established as in the laboratory experiment all extraneous factors are controlled and the pure effects of intervention can be studied.	4) The cause effect relationship can be established to quite an extent but not to the same accuracy of experimental research as extraneous factors are not controlled as in the laboratory.
5) Predication based on the experiment is possible and one can even accurately predict a phenomenon given the same conditions.	5) Prediction is possible to certain extent as the real life situation may not be the same in all places where the study is conducted.
6) The experiment is always quantitative in terms of results.	6) The field experiment is both qualitative and quantitative in terms of results.
7) The experiment is replicable.	7) The field experiments are replicable but may require modifications in terms of the matching factors.

We can use the experimental research in different ways such as:

- There is time priority in a causal relationship (cause precedes effect)
- There is consistency in a causal relationship (a cause will always lead to the same effect)

- The magnitude of the correlation is great.

The word experimental research has many meanings.

This is an experiment where the researchers manipulate one variable, and control the others variables. It can have a control group for comparison purposes, but invariably as the experimental situation is highly controlled in the laboratory, one group is sufficient for the experiment. The subjects are randomly assigned to experimental conditions if there are more than two experimental conditions. The researcher must be very clear as to what variable(s) need to be tested and measured.

Field experiments are also called as quasi experiments, as the researcher actively influences something to observe the consequences.

When dealing with human subjects it is always possible and advisable to use field experiments or quasi experiments. This is so because when certain phenomenon and its changes are observed in natural settings, it provides considerable inputs, information and knowledge about the phenomenon in real life situation. If society has to progress this type of research is important.

3.3 STRENGTHS AND WEAKNESSES OF FIELD EXPERIMENTS

The advantages or the strength of field experiments are given below:

- 1) It is useful to behavioural and social scientists such as the social psychologists, sociologists and educationists.
- 2) It is an appropriate method for studying complex social influences, processes, and changes in life like setting. The dynamics and small groups have been fruitfully studied by this method.
- 3) It is most suited method to the testing of theory and to the solution of practical problems.
- 4) It is suited to testing broad hypotheses.
5. Flexibility and applicability to a wide variety of problems are also possible by this method.

Weaknesses or limitations of field experiments are as given below:

- 1) The chances of extraneous variables confounding the research findings are more in field experiments due to the uncontrolled extraneous variables.
- 2) One of the problems is the negative attitude of researcher.
- 3) Consent and cooperation of concerned subjects and the institutional authorities, (the institution where the research is to be conducted) is required for the field experiment.
- 4) This type of research faces lack of precision problem.

3.4 CONSTRUCTING THE FIELD EXPERIMENT

Before constructing an experiment research there are various aspects to consider.

- 1) *Planning*: A good planning always ensures that the research is carried out properly and in proper conditions with appropriate tools and measures.
- 2) *Sampling*: One of the best ways to ensure that the research is conducted systematically and appropriately is to have a proper selection of sample. **Sampling** is taking any portion of a population or universe as representative of that population or universe. Sample can be classified into *probability* and *non probability sample*.

Probability samples use some form of random sampling in one or more of their stages. Non probability samples do not use random sampling; they thus lack the virtues being discussed. Still, they are often necessary and unavoidable.

The probability sampling includes stratified, cluster, systematic and random sampling method.

The non probability sampling includes quota, purposive and accidental sampling method.

- 3) *Research design*: Every research requires a blue print of the research work that will be carried out. Where the experiment will be conducted, that is the setting, who will be the subjects, that is the sample, how it will be conducted, what instruments will be used, what will be manipulated, what will be measured etc. The experimental design must also provide for the number of subjects that will be in the experiment and the number of subjects who will be considered as the control group.
- 4) *Tools of data collection*: What are the tools that will be used, how the results will be measured, and what statistical tools will be used etc.
- 5) *Procedure*: Once the subjects have been identified and setting has been decided where the experiment will be conducted, the next step is to get permission from authorities to use the setting. Having obtained the permission let us say from school authorities to conduct field experiment regarding which method of teaching leads to better academic performance, the subjects will be selected from a certain class. Let us say we choose children from class 5 all sections. Let us say there are 200 children. We need only 100 children and so from each of the 4 sections we take 25 out of 50 children randomly. From these 100 children, we again take 50 for control group and another 50 for experiment. This again we select randomly. Both the groups children are tested for academic performance and their scores are recorded. Then, to the experimental group of children we give instruction through lecture method and to the other group through tutorial method. After training for 1 month, the academic performance of both the groups are retested. Now the difference in the second testing for the two groups will indicate which method is more effective. Within the group also the pre and the post test performance could be measured and the difference noted as improvement or decrease in academic performance.
- 6) *Statistical analysis*: Appropriate statistics such as the t test will be used to find if the differences obtained between the two groups as well as between the pre and the post tests are statistically significant.

The above 6 steps are the ways in which the field experiment is conducted.

3.5 RESEARCH DESIGN

Research can be explained as Re + Search= again + explore, to explore the relationship between different variables. Research is a scientific methodology in a controlled setting. Observation and experiments are the basic scientific tools of research which gives the scientific status to the field of psychology. It is a systematic attempt to study.

The controlled observation means that we have to see the impact of independent variable and dependent variable under specific controlled condition and we have to manipulate the independent variable in a systematic way and record the relative changes in the dependent variable. For controlled observation it is essential for one to manipulate independent variables with certain controls and the principles of randomisation should be followed. In other words a good research design is that in which we can forecast or give a solution to the problem.

According to Kerlinger (1998), Research design is the

- i) *plan*,
- ii) *structure*, and
- iii) *strategy* of investigation.

The research design is conceived so as to obtain answers to research questions and to control variance. The above three aspects of research design are being explained below:

- i) Plan is the overall scheme or programme of the study. It can be in the form of proposal of the study.
- ii) Structure of the research is more specific. It is the outline, the scheme, the paradigm of the operation of the variables.
- iii) Strategy is more specific than plan. The method that we want to use to collect the data and analyse or interpret the data. The strategy also implies as to how the research objectives will be reached and how the problems encountered in the research will be tackled.

According to Myers (1980), the design is the general structure of the experiments, not its specific content.

Self Assessment Questions

State whether the statement is *True or False*.

- 1) The selection of a problem is the last step of research ().
- 2) After defining the research problem the hypothesis must be formulated ()
- 3) Experimental research use in science subjects ()
- 4) Field experiments refer in the real life situation ()
- 5) Flexibility and applicability is a weakness of field experiments ()
- 6) Structure is more specific than plan ()

3.6 OBJECTIVES OF RESEARCH DESIGN

The research design has two basic objectives:

- i) **To provide answers to research questions** – The investigator has the answer to research questions in the form of validity, objectivity, accuracy and economical aspects of the research concerned. The researcher is not inclined to answer the research questions in a layman's term but answer in terms of validity, objectivity, accuracy etc. For example, the factorial design is a design which deals with the interaction effect in an economical way. Different research problems require different research designs.

Research problems can be and are stated in the form of hypotheses and the research designs are carefully worked out to yield dependent and valid answers to the research questions epitomised by the hypotheses. If the hypothesis discussed is one of interaction, a factorial design is evidently more appropriate (Analysis of variance is used in factorial design). The adequate planning and executed design helps to make efficient observation and draw appropriate inferences from the result.

An adequate research design would suggest the number of observations that have to be made, and which variables are active and which are attributed etc. According to the adequate research design we can then act to manipulate the active variables and to categorize the attribute variables.

- ii) **To control variance under study**– The score deviation is called variance and these variances must be controlled. The investigators follow certain principles for constructing an efficient research design.

Principle 1: *To maximise the variance of variable*

The main concern of the investigators is to maximise the variance in a systematic way. It is called the *experimental variance*.

The Variance of the dependent variable (DV) is influenced by the independent variable (IV). The main task of an experimenter is to maximise the variance.

If the independent variable does not vary substantially, there is little chance of separating its effect from the total variance of the dependent variable.

Hence it is necessary to give chance to the variance to show itself separately from the total variance. The purpose of a good research design is to maximise systematic variance.

Principle 2: *To control extraneous variance*

The purpose of the effective research design is to control extraneous variance which may confound the results of the experiment.

There are three ways to control extraneous variables confounding the results:

- i) to eliminate the variable as a variable;
- ii) to control extraneous variance through randomisation,
- iii) to build it right into the design as an independent variable.

Principle 3: To minimise error variance

Our aim is to minimise error variance from the research study. It is unpredictable. Some time we see the impact of constant error in the study. For example, individual differences and intelligence. This type of error affects adversely the research findings.

We can minimise the error variance by two basic methods:

- i) the reduction of errors of measurement through controlled conditions and
- ii) an increase in the reliability of measures.

3.7 CRITERIA FOR A GOOD RESEARCH DESIGN

For research design to be considered good, we must ask the following questions?

- 1) Does the design give specific answer to the research question?
- 2) Does the design adequately test the hypothesis?
- 3) Does the design present the appropriate question/problem?
- 4) Does the design adequately control the extraneous independent variable?
- 5) Can we generalise the results of a study to other subjects?
- 6) Does the design give the internal and external validity?

3.8 TYPES OF EXPERIMENTAL RESEARCH DESIGNS

The pure experimental research is not always possible in behavioural and social sciences due to the difficulty in controlling all the variables and influences from outside of and inside the individuals which is possible only within a laboratory situation. The experimental situations in which experimenter can manipulate the independent variables and has liberty to assign subjects randomly to the treatment groups and the control groups may not be that possible or accurate. Also the control of the extraneous variables is not possible and children in a classroom keep getting stimulation from various sources. Hence one has to take such designs in which to the extent possible randomisation and control of variances are possible.

To conduct the field experiments there are experimental designs available and these are being discussed below. Let us consider the different types of designs:

3.8.1 Single Case Experimental Design

The single case experiment is useful in clinical research especially in the area of behaviour modification. This design provides us the detailed information of human behaviour which is not possible in the group designs. Repeated measurements are also possible and we can note subtle changes in the subjects' behaviour.

The design however is not very suitable for generalising the findings to the larger population as it is based on a small number of subjects and who have not been randomly selected.

3.8.2 Quasi-Experimental Design

All experimental situations in which the researcher / experimenter does not have full control over the assignment of experimental units randomly to the treatment conditions or the treatment cannot be manipulated, are collectively called quasi-experimental designs.

There are the various experimental situations in which the experimenter does not have full control over the situations. The plan of such experiments constitutes the quasi- experimental design.

Though, quasi-experimental investigations have limitations, nevertheless these have advantages in certain respects. It is possible to select subjects randomly as pointed out earlier in the case of selecting students from class 5 of a school and randomly assign them to the experimental and control groups respectively. We conduct the experiment in natural and real life setting and so it has certain amount of realism and the information so gathered can also be to quite an extent generalised. It can provide answers to several kinds of problems about past situations and those situations which cannot be handled by employing pure experimental research design.

3.8.3 Experimental Design

This type of design is generally conducted in the laboratory with complete control over all variables and all subjects. In this type of research design one can assign subjects randomly to the treatment groups and one can manipulate the independent variable and study the pure effects of the manipulation on the dependent variable. Also, in such experiments, the experimenter has complete control over the scheduling of independent variables. In such experiments one can use high level advanced statistical methods to analyse the data. For example, the *F* test, Correlation and regression and multiple regression analysis, partial correlation etc. There are also three types of designs that we can use within the experimental design and these are (i) Between subjects design (ii) Within subject design and (iii) Mixed design (iv) classical pre test post test design (v) Solomon four groups design (vi) Factorial design. These are presented in detail below:

- i) *Between subject design* – Each subject is observed only under one of the several treatments conditions.
- ii) *Within subject design or repeated measures design* – Each subject is observed under all the treatment conditions involved in the experiment.
- iii) *Mixed design* – Some factors are involved from between subjects and some are from within subjects.
- iv) *Classical pretest-post test* – The total population of participants is randomly divided into two samples; the control sample, and the experimental sample. Only the experimental sample is exposed to the manipulated variable. The researcher compares the pretest results with the post test results for both samples. Any divergence in the results between the two samples is assumed to be a result of the experiment.
- v) *Solomon four group design* – The sample is randomly divided into four groups. Two of the groups are experimental samples. Two groups experience no experimental manipulation of variables. Two groups receive a pretest

and a post test. Two groups receive only a post test. This is an improvement over the classical design because it controls for the effect of the pretest.

- vi) *Factorial design* – This is similar to a classical design except additional samples are used. Each group is exposed to a different experimental manipulation.

All the above designs of research can be used in experimental research work for analysing the data. On the other hand these designs are not suitable for conducting field experiments though one could use them with certain modifications.

Having presented the experimental research and field experiment, the following section presents in detail the basis issues related to research design.

Self Assessment Questions

Fill in the blanks

- 1) Research problem can be stated in the form of
- 2) Research is a methodology in a controlled setting.
- 3) The main task of an experimenter is to maximise the
- 4) The experiment is useful in clinical research.
- 5) design is generally conducted in the laboratory with complete control over all variables and all subjects.

3.9 LET US SUM UP

The key points of our discussion in this unit have been as given below:

Experimental research is a systematic and scientific approach to research in which the researcher manipulates one or more variables, and controls and measures the other variables.

Research is a scientific methodology in a controlled observation and experiments are the basic tool, which gives the status of science of psychology. It is a systematic attempt to study.

The research design has two basic objectives: (i) To provide answers to research questions and (ii) To control variance under study.

Field experiment on the other hand is carried out in real life situation and deals with real life related problems and thus is important for our society.

It helps us to improve our everyday living lives and it is also able to predict the many important social phenomena. Typically, an experiment is constructed to be able to explain some kind of causation.

It has some strength and weakness of field experiment. The three types of experimental research design are (i) single case experimental design, (ii) quasi-experimental design, (iii) experimental design.

3.10 UNIT END QUESTIONS

- 1) Define experimental research.
- 2) Differentiate between experimental research and field experiment.
- 3) Define research design.
- 4) Explain two basic objectives of research design.
- 5) Explain the importance of field experiment in research.
- 6) How can we check the criteria of a good research design?
- 7) What are the three types of experimental research, explain each.
- 8) Explain Solomon four group designs.

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3.12 ANSWERS TO THE SELF ASSESSMENT QUESTIONS

True or False

- 1) False, 2) True, 3) True, 4) True, 5) False, 6) False

Fill in the blanks

- 1) hypothesis, 2) scientific, 3) variance, 4) single case, 5) experimental.

UNIT 4 CASE STUDY

Structure

- 4.0 Introduction
- 4.1 Objectives
- 4.2 Nature of Case Study
- 4.3 Criteria for Selection of Case Study
- 4.4 Types of Case Study
- 4.5 Steps for Case Study
- 4.6 Ways of Case Studies
- 4.7 Misconception about Case Study
- 4.8 Let Us Sum Up
- 4.9 Unit End Questions
- 4.10 Suggested Readings and References
- 4.11 Answers to Self Assessment Questions

4.0 INTRODUCTION

Earlier you have studied about the survey research, ex-post-facto research and experimental research. Now we are going to read about the case study method in research work. In the field of social sciences case study is important tool for a good research methodology. It can be apply on the single subject, small and large group, a class within a school, a school with in a city, or event. Case study methods involve an in-depth study, longitudinal examination of a single subject or event and it may be descriptive or explanatory. A case study is not different to a survey method, but instead of collecting data about few factors from a large number of units the researcher makes a depth and intensive study of a single subject. It is limited in scope but more exhaustive and more informative as compared to survey. It can be used in a school atmosphere, for example, a teacher may use case study to identify the causes of failure in mathematics of a group of three students in class V of a village primary school who continuously failed in three unit tests. The teacher will study these cases in detail in order to arrive at the specific causes of the failure of these students and then take a decision about the remedial measures, which may be taken to overcome the problem of failures. In this unit you will be understand the nature of case study, criteria and types of case study.

4.1 OBJECTIVES

After going through this unit, you will be able to:

- Define case study;
- Explain the nature of case study;
- explain the criteria for selection of case study;
- Delineate the types of case study; and
- describe the steps involved in case study.

4.2 NATURE OF CASE STUDY

Case study provides a systematic and scientific way of perceiving or examining events, collect data, analyse information, and prepare a report. As a result the researcher may gain a sharpened understanding of why the instance happened as it did, and what might become important to look at more extensively in future research. Case studies lend themselves to both generating and testing hypotheses.

In other words, case study should be defined as a research strategy, an empirical inquiry that investigates a phenomenon within its real-life context. Case study research means single and multiple case studies, can include quantitative evidence, relies on multiple sources of evidence and benefits from the prior development of theoretical propositions. Case studies based on any evidence of quantitative and qualitative research.

Single subject-research provides the statistical framework for making inferences from quantitative case-study data. According to Lamnek (2005) “The case study is a research approach, situated between concrete data taking techniques and methodologic paradigms.”

In the past years, case study method was used in the field of clinical psychology to examine the patient’s previous history regarding the person’s mental health status. To know about the patient’s physical and mental health, and to make an accurate diagnosis, it is very important to know about the patient’s past and present health related and environmental problems and issues.

Psychoanalyst Sigmund Freud used case study method to assist his subjects in solving personality problems. The detailed accounts of interviews with subjects and his interpretations of their thoughts, dreams and action provide excellent examples of case studies. Guidance counselors, social workers and other practitioners conduct case studies for diagnosing particular condition or problem and recommending remedial measures. They collect data from a particular individual and confine their interest to the individual as a unique case or collect data from a small group of individuals, which form a unit for depth study.

The case study approach is based on reality. Some of these studies have been conducted in school environment, which have mostly centered on behavioural problems of children. Observation, interviews, psychological tests and inventories have been used for collecting relevant data about the case or cases. However, subjective bias is a constant threat to objective data gathering and analysis techniques. The researcher must be thoroughly familiar with the skills which are associated with the conduct of case-studies.

The Case study is also useful in psychology. It refers to the use of a descriptive research approach to obtain an in-depth analysis of a person and group. The various techniques may be applied on the subject such as personal interviews, observation, psychometric tests, and archival records. We can use the case study method in clinical psychology to describe rare events and conditions. Generally case study is a single-case design, but it can be a multiple-case design, where replication instead of sampling is the criterion for inclusion. One thing we must remember about the case study is that it must provide valid and reliable results for the development of future research.

4.3 CRITERIA FOR SELECTION OF CASE STUDY

For selection of cases for the case study, we often use information oriented sampling. Our cases are based on this only information, which is mostly based on the extreme cases or typical cases. The average case is often not the richest in information. Extreme or a typical case reveals more information because they activate more basic mechanisms and more actors in the situation studied.

In addition, from both understanding oriented and action oriented perspectives, it is often more important to clarify the deeper causes behind a given problem and its consequences, than to describe the symptoms of the problem and how frequently they occur, etc.

Random samples emphasising representativeness will seldom be able to produce this kind of insight. It is more appropriate to select a few cases for their validity, but this is not always the case. Three types of information oriented cases may be distinguished:

- Critical cases
- Extreme or deviant cases
- Paradigmatic cases

Yin (2005) suggested that researchers should decide whether to do single-case or multiple-case studies and choose to keep the case holistic or have embedded sub-cases.

4.4 TYPES OF CASE STUDY

There are four types of case studies which are (i) illustrative case studies (ii) exploratory case studies (iii) cumulative case studies and (iv) critical instance case studies.

- 1) **Illustrative Case Studies:** These are primarily descriptive studies. They typically utilise one or two instances of an event to show what a situation is like. Illustrative case studies serve primarily to make the unfamiliar familiar and to give readers a common language about the topic in question.
- 2) **Exploratory (or pilot) Case Studies:** This type of case studies performed before implementing a large scale investigation. Their basic function is to help identify questions and select types of measurement prior to the main investigation. The primary pit fall of this type of study is that initial findings may seem convincing enough to be released prematurely as conclusions.
- 3) **Cumulative Case Studies:** These serve to aggregate information from several sites collected at different times. The idea behind these studies is the collection of past studies will allow for greater generalisation without additional cost or time being expended on new, possibly repetitive studies.
- 4) **Critical Instance Case Studies:** These examine one or more sites for either the purpose of examining a situation of unique interest with little to no interest in generalisability, or to call into question or challenge a highly generalised or universal assertion. This method is useful for answering cause and effect questions.

4.5 STEPS FOR CASE STUDY

The following steps are used in the conduct of a case study:

Step 1. Determining the present status of the case or cases

The first step is to determine the present status of the case or cases through direct observation. In addition to physical examination of the case or cases, a psychological evaluation is required to determine the general ability level etc. For example, to make a case study of a 'slow learner', the first thing to do is to determine the present status of the child by making an assessment of his physique cognitive factors through direct observation and psychological test.

Step 2. Identifying the most probable antecedents of the case or cases

Determining the most probable antecedents of the case or cases is the next important steps. This information helps in formulating a workable hypothesis or a set of hypothesis. For example, in case of 'slow learner' cited in Step 1, the researcher may formulate a hypothesis that occurrence of slow learning behaviour in the child is due to unhealthy home environment, bad study habits and poor teaching in the school.

Step 3. Verification of Antecedents/Hypotheses

The case is then checked for the presence or absence of the antecedents supposed to apply to situation of under study. For example, the behaviour of slow learning of the child. This involves multi-method approach, which includes observation, past history of the case, interview etc.

Step 4. Diagnosis and Remedial Measures

After the verification of the antecedents or hypothesis (es), the next step is directed towards the diagnosis of the causes (example, causes of slow learning) and suggesting remedial measures in the light of the causes.

Step 5. Follow-up of the case or cases

The last step of the case study is the follow-up of the case (es) to study the impact of remedial measures. If impact is positive, the diagnosis is taken to be correct.

4.6 WAYS OF CASE STUDIES

There are different ways of using case studies, which are given below:

1) Writing analysis of case study

The most careful analysis of a case study is probably obtained when it is made in writing. Case studies can be used as term papers with other related readings and bibliographies.

2) Panel of experts

Although group members miss the advantages of participation, listening to a panel of experts a case may be useful especially as an introduction to the case method. A variation of this technique would be to bring in a panel of experts to analyse a case after a group had already done so.

3) Analysis of similar case studies

Another variation of case discussion is to collect from the group members incidents from their experience similar to the case under consideration. Generalisations drawn from the case under consideration may carry over to the experiences of other members.

4) Cross examination

By cross examination group members with questions prepared in advance, they will discover that it is necessary to do careful thinking and preparation before entering into case study. This technique, especially appropriate for use with cases containing a great deal of detail, gives the researcher many opportunities to ask individuals to defend their points of views in terms of the data presented.

Self Assessment Questions

A) State whether the statement *True or False*

- 1) Case study involves in-depth study ()
- 2) Case study provides a systematic and scientific ways of perceive ()
- 3) Case study can be used only in clinical psychology ()
- 4) The approach of case study is based on the artificial atmosphere ()
- 5) Critical case studies are useful for cause and effect questions ()

B) Fill in the blanks

- 1) Case study means single and _____ case studies.
- 2) Case studies based on any evidence of quantitative andresearch.
- 3) case study performed before implementing a large scale investigation.
- 4) is the last step of case study.

4.7 MISCONCEPTION ABOUT CASE STUDY

There is little misconception about the case study for using in research work. Flyvbjerg (2006) define five misconceptions about case study research:

- 1) Generally, theoretical knowledge is more valuable than concrete, practical knowledge, because one cannot generalise on the basis of an individual case and, therefore, the case study cannot contribute to scientific development.
- 2) The case study is most useful for generating hypotheses, whereas other methods are more suitable for hypotheses testing and theory building.
- 3) The case study may affect the bias tendency toward verification, i.e., a tendency to confirm the researcher's preconceived notions.
- 4) Some time it is difficult to summarise and develop general propositions and theories on the basis of specific case studies.

4.8 LET US SUM UP

The key points of our discussion in this unit have been that case study is an important area of research which helps the researcher to study the individual and develop appropriate strategies to provide remedial instructions. In this unit attempt is made to make you aware about the systematic steps of case study on the basis of which strategic interventions can be planned for the development of a particular aspect.

Case study is also useful in psychology. It refers to the use of a descriptive research approach to obtain an in-depth analysis of a person and group. The various techniques can be applied on the subject such as personal interviews, observation, psychometric tests, and archival records.

There are four types of case study (i) illustrative case studies, (ii) exploratory case study, (iii) cumulative case study, and (iv) critical instance case studies.

There are various steps to conduct the case studies such as, *Step 1* Determining the present status of the case or cases; *Step 2* Identifying the most probable antecedents of the case or cases; *Step 3* Verification of Antecedents/Hypotheses; *Step 4* Diagnosis and Remedial Measures; and *Step 5* Follow-up of the case or cases.

There are the different ways to using case study such as, (1) Writing analysis of case study, (2) Panel of experts, (3) Analysis of similar case studies, (4) Cross examination.

4.9 UNIT END QUESTIONS

- 1) What do you mean by case study method?
- 2) How can we use case study method in psychology?
- 3) What are the criteria of case study?
- 4) Explain types of case study.
- 5) What are the important steps to conduct the case study?
- 6) Explain ways of using case studies.

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4.11 ANSWERS TO SELF ASSESSMENT QUESTIONS

A) True or False

1) True, 2) True, 3) False, 4) False, 5) True.

B) Fill in the blanks

1) multiple, 2) qualitative, 3) exploratory, 4) follow-up.

UNIT 1 SINGLE FACTOR DESIGN

Structure

- 1.0 Introduction
- 1.1 Objectives
- 1.2 Meaning of Research Design
- 1.3 The Function of A Research Design
- 1.4 Basic Terminology in Research Design
- 1.5 Single Factor Design
- 1.6 Let Us Sum Up
- 1.7 Unit End Questions
- 1.8 Glossary
- 1.9 Suggested Readings

1.0 INTRODUCTION

There are several ways of collecting and understanding information and finding answers to question, research is one way. Research is a way of thinking. The main purpose of research is developing and testing new theories for the enhancement of knowledge. In research we work within a framework of a set of theories, use methods and try to be unbiased and objective.

When we intend to do research, the first thing we have to do is to decide *what research question we want to find answers to*. Having decided our research question or problem we now have to decide *how to go about finding their answer*. There are various steps through which we just pass in our research journey in order to find the answers to our research questions. Conceptualising a research design is one of the important steps in planning a research study. The main function of a research design is to explain how we will find answers to the research question. For any investigation the selection of an appropriate research design is crucial in enabling us to arrive at valid findings and conclusion. There are different types of research design. In this unit we will learn about one commonly used research design namely single factor design.

1.1 OBJECTIVES

After reading this unit, you will be able to:

- Define research design;
- Describe the function of a research design;
- Identify the terms of research design;
- Define Single factor research design;
- Explain Between group research design; and
- Describe Within subject research design.

1.2 MEANING OF RESEARCH DESIGN

Research design is the plan, structure and strategy of investigation conceived so as to obtain answers to research questions and to control variance. The plan is the overall scheme or the program of the research. It includes an outline of what the investigator will do from writing the hypothesis and their operational implications to the final analysis of data. Structure of the research is outline of the research design, and the scheme is the paradigm of operation of the variable. Strategy includes the methods to be used to gather and analyse the data. In other words, strategy implies how the research objective will be reached and how the problems encountered in the research will be tackled. (Kerlinger, 2007).

A traditional research design is a blueprint or detailed plan as to how a research study is to be completed. That is, how it would operationalise variables so that they can be measured, how to select a sample of interest to the research topic, how to collect data to be used as a basis for testing hypothesis, and how to analyse the results. (Thyer, 1993).

Thus in brief we can say that a research design is a plan adopted by the researcher to answer research question.

1.3 THE FUNCTION OF A RESEARCH DESIGN

On the basis of above definition it can be said that the function of research design is (i) to provide answer to research question and (ii) to enable the researcher to answer research question as validly, accurately and as economically as possible.

According to Kerlinger (2007), the research design has two basic purposes, (i) to provide answer to research question and (ii) to control variance. In other words, the purpose of research design is to get dependable and valid answers to research questions. Research problems are stated in the form of hypothesis. The research design guides the researcher how to collect data for testing the formulated hypothesis.

The main function of research design is to control variance. The statistical principle behind this mechanism is MAXMINCON principle, that is, Maximise systematic variance, Control extraneous variance and Minimise error variance. (Kerlinger, 2007).

Systematic variance is the variability in the dependent measure due to the manipulation of the independent variable. In addition to independent and dependent variables, there are other variables that may influence dependent variable known as extraneous variable. Different methods are used to control the extraneous variable and some of these methods are for example, randomisation, elimination and matching. The term error variance means those variance which occur due to the variables that are not controllable by the experimenter.

1.4 BASIC TERMINOLOGY IN RESEARCH DESIGN

It is essential to get familiar with some term for clear and better understanding of the design.

i) **Factors**

The independent variable of an experiment are known as factor of the experiment. An experiment always has at least one factor.

ii) **Levels**

A level is a particular value of an independent variable. An independent variable has at least two levels. For example if we are intended to see the effect of reward on verbal learning. Then reward is the factor and it has two levels, reward or no reward.

iii) **Treatment**

It refers to a particular set of experimental condition. For example in 2×2 factorial experiment the subject are assigned to 4 treatments.

Self Assessment Questions

1) Define research design and indicate its puposes.

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2) What are the functions of a research design.

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3) Define factors, levels and treatment in research design.

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1.5 SINGLE FACTOR DESIGN

When we have only one independent variable then we use single factor design. Single factor design can be classified into two categories :

- i) Between group design
- ii) Within subject design

i) *Between group design*

Here subjects are assigned at random to different treatment conditions. Here the effect of different conditions on the subjects are computed. In this you can have (i) two randomised group design or (ii) Multigroup design.

As for the two randomised group design, in this we randomly assign the subjects into two groups. For this type of design, the experimenter first defines the independent variable, dependent variable and the research population. For example an investigator wants to see the effect of knowledge of result on the rate of learning of school students in a particular city. Researcher randomly selects a sample of 100 students from a city. Then researcher will randomly divide these 100 students in two groups with 50 students in experimental group and 50 students in control group. The random assignment of the subjects into two groups can be done by various methods.

The most common method of randomly assigning the subjects into two groups is to use the table of random number. To divide the subjects into experimental and control group, the researcher may write down the name of all the students in alphabetical order on a paper and assign 1st student in experimental group, the 2nd in control group, 3rd in experimental group and so on. The researcher also may write the name of the subjects on separate slips fold them and place them in a box and pick the slip one by one. The experimenter may place first slip in one group and second in the second group. It is expected that these two groups will not differ significantly at the start of the experiment. Now the students of experimental group will receive the knowledge of result of their performance and the students of control group do not receive the feedback of their performance. Then the scores of all subjects of experimental and control group will be recorded and subjected to statistical analysis. If the statistical test reveals that two groups differ significantly on dependent variable then it can be concluded that the difference in rate of learning is due to the manipulation of independent variable. If the rate of learning of experimental group is more than that of the control group, then we may conclude that knowledge of result facilitated the learning.

In two randomised group design 't' test or Mann-Whitney U test is most commonly applied statistical techniques design.

- *More than two randomised group design or multi group design*

In behavioural science, the researcher some times uses more than two randomised group design. In such studies, there are more than two or three experimental groups and one control group. For example in an educational experiment, let us say that we want to study the effect of schedule of reinforcement on the rate of learning of a verbal task. We have three experimental groups and one control group. The experimental group (G_1) receives reinforcement of every response, while the experimental group 2 (G_2) receives reinforcement at regular time interval, and the third experimental group (G_3) receives reinforcement at random interval and the control group (G_4) receives no reinforcement. We measure the rate of learning on the verbal tasks of all these groups and use statistical technique to answer research question.

In more than two randomised group design some time we have three or four experimental groups only. For example an experimenter wants to study the effect

of four teaching methods on learning of a particular task. Suppose for this, the researcher randomly selects 100 students and assign 25 subject randomly in each group. These groups are supposed to be equivalent groups after random assignment. In the experiment, one group will be taught by method A, the second by method B, third by method C and fourth by method D. All subjects were administered a particular task and the scores are obtained on dependent variable. Through appropriate statistical technique we can find out which method of teaching is most effective. In multi group design the two most commonly applied statistic is the one way analysis of variance and Duncan Range test.

- *Matched group design*

This design is also known as randomised block design (Edwards, 1968). In matched group design all subjects are first tested on a common task and then they are formed into groups. The groups thus formed are known as equivalent groups. Subsequently, the different values of the independent variable is introduced to each group and the mean scores of the dependent variable is taken of both the groups. The matching variable is usually different from the variable under study but is, in general related to it. The two groups are not necessarily of the same size although there should not be large differences in the number of subjects of two groups.

When we use the matched group design the most important factor is the identification of the variables on which matching has to be done. The matching variable should have high correlation with dependent variable. Some time the dependent variable itself is used as matching variable. Some time an independent measure may be used as matching variable. But the variable selected should be somewhat related to the dependent variable. For example in a study the researcher wants to see the effect of praise on subject's performance on intelligence test. We have two groups, one group is praised for its performance on the test and urged to try to better its scores and the second group does not receive any comment. For assigning the subjects into two groups the researcher may find the scores on form A of the intelligence test and obtained the set of scores. On the basis of the obtained scores on form A subjects can be paired off. Those subjects who scored 100 were selected for the study. They were divided into two groups randomly and form B of the same test was administered to see the effect of incentive on subject's score. Suitable statistical test is used to find-out the significant difference in the mean scores of two groups.

In matched group design we may use two methods of matching.

Matching by pairs

In this type of research, matching is done initially by pairs so that each person in the first group has a match in the second group. For example researcher wants to study the effect of two teaching methods on mathematical achievement of the IX grade students. Subjects Intelligence and academic achievement was taken as matching variable. All subjects were administered mathematical academic achievement test and scores were obtained. If for instance two subjects scored 80, then one subject is placed in one group and another is placed in another group. In this way two groups are formed. One group is taught by one method and another group is taught by another method and academic achievement scores of both the groups are compared.

Matching in terms of mean and SD

When it is impractical or impossible to set up groups in which subjects have been matched person to person, investigators often resort to matching of groups in terms of Mean and Standard Deviation. The matching variable is somewhat related to the dependent variable. For example intelligence is a matching variable and the researcher obtained the mean and SD of intelligence scores of two groups.

In the matched group design the subject may be matched on age, educational level, learning ability and so on. However one should be very careful in choosing the matching variables.

Self Assessment Questions

1) Define Single Factor Design.

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2) What is between group design? Describe the same with examples.

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3) Describe more than two randomised group design or Multi group design.

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4) What is Matched group design?

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5) How do we match in Matched Group Design?

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ii) *Within subject design*

Within subject design is also known as repeated measure design, because the same individual is treated differently at different times and we compare their scores after they have been subjected to different treatment conditions. For example, let us say a researcher wants to study the effect of colours on reaction time. The investigator selects three colours say red, green and yellow and let us say that 10 subjects are selected for the experiment from the population of interest. After exposing them to different colours, their reaction time is noted and compared.

Within subject design is further divided into two categories, viz., (i) two conditions within subject design and (ii) multiple condition within subject design.

- *Two conditions, within subject design*

The two conditions design is the simplest design. The two conditions are labeled as 'condition 1' and 'condition 2'. All subjects experience both the conditions. Let us say that the researcher wants to compare the reaction time of red and green colour. We select 10 subjects from the population of interest, and the reaction time of all the subjects is noted down for the two colours. Despite its simplicity, this design is not used as often as one might expect because many experimenters involve more than two conditions and there is possibility of carryover effect from one condition to the other.

- *Multiple Conditions within subject design*

Psychology experiments generally employ more than two conditions. Usually the researcher wants to compare several variables or treatments and ascertain their effectiveness. Another reason for conducting multiple conditions experiment is to determine the shape of the function that relates the independent and dependent variables. For example a researcher may want to know how the sensation of brightness increases with the physiological intensity of a light. For this the researcher may present each of several intensities of the light to a group of subjects. From the responses to the various intensities, the researcher can plot the relation between intensity and brightness. This design can be explained by an example.

Fergus, Craik and Endel Tulving (1975) examined whether different strategies of processing words would affect memory. They used different strategies for processing the word. They flashed words on a screen. Before each word appeared they asked the subject a question, "Is the word in capital letters?" or "Does the word rhyme with train?" or "Does the word fit in this sense?" The first strategy focused on the visual properties of the word, the second on the acoustic properties and the third on the semantic properties. Researcher hypothesised that each successive type of strategy would induce greater "depth of processing". Their theory predicted that increasing the depth of processing, would increase the memory for that word.

The experimenter believed that subject could adopt different strategies of processing on different trials. The type of strategy used was randomly varied for each trial. After the words were all presented, the experimenter gave the subject a list which contained all of the words that the experimenter had presented along with an equal number of words that they had not presented. They asked the subjects to indicate which word they recognised from the list. The percentage

of words recognised varied as a function of the depth of processing induced by the question. The subject recognised only 18% of the visually processed words, but they recognised 70% of the acoustically processed and 96% of the semantically processed words. The following table shows schematically the above design :

Table 1.1: Subjects and treatment conditions

Subjects	Treatment		
	T ₁	T ₂	T ₃
1	S ₁	S ₁	S ₁
2	S ₂	S ₂	S ₂
3	S ₃	S ₃	S ₃
-	-	-	-
-	-	-	-
N	S _n	S _n	S _n

- *Controlling for order and sequence effects in within subjects design*

In the within subject experiment, because a subject experiences more than one experimental conditions, the possibility exists that **order** effect and **sequence** effect may influence the result of the repeated testing.

Order effects according to Mcburney and White (2007); “are those that result from the ordinal position in which the condition appears in an experiment, regardless of the specific condition that is experienced”. On the other hand, according to them, the sequence effect “depends on an interaction between the specific conditions of the experiment.” For example in an experiment when judging the heaviness of lifted weights, there is possibility that a light weight will feel even lighter if it is followed by a heavy one, and vice-versa.

Controlling for order and sequence effect is possible by randomisation, which can be used when each condition is given several times to each subject. For example if there are four conditions and each one is to be presented twice, we may use the following sequence BCAD, ADCB. This type of randomisation is particularly useful when conditions are presented several times to each subject.

When we have relatively fewer subjects, then several conditions can be presented only a few times. Then we can use the reverse **counterbalancing** to control for order effect. For example we have three conditions ABC then we can present them ABC, CBA sequence.

- *Comparison between group and within subject design*

In the within subject design each subject in the experiment receives a number of treatments or conditions whereas in the ‘between subject’ design, a subject receives only one treatment.

In within subject design the experimenter repeats the measures on the same group of subject and this increases the precision of the experiment by eliminating inter-subject differences as a source of error.

Whether we will use the between group design or within subject design depends on the experimental situation. When there are chances of practice or carry over

effect of one treatment to the subsequent task, then between group design should be preferred.

When we have small number of subjects, and they are available for extended period of experimentation and number of treatment is small then we should prefer within subject design.

Self Assessment Questions

- 1) Define within subject design. State the two categories of within subject design.

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- 2) Describe what is 2 conditions and Multiple conditions in “within subject design”? Give suitable examples.

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- 3) How do we control for order and sequence effects in “Within Subjects Design”?

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- 4) Compare Between group and within group designs.

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1.6 LET US SUM UP

Research design is a detailed plan as to how to do the research. The aim of research design is to give answer to research problem and control variance. There are different types of research design. When we have one independent variable then we use single factor research design. Single factor research design can be classified as between subject and within subject design and also known as repeated measure research design. In between subject design we have two groups, one is experimental group and other is control group. The allocation of subject in experimental and control groups is made randomly. In within subject design different subjects are treated differently at different times and we compare their scores after subjecting them to different treatment conditions. In within subject design, control of order and sequence effect is achieved through randomisation or counterbalancing.

1.7 UNIT END QUESTIONS

- 1) Given below are statement. Indicate whether they are true or false :
 - i) The research design is used to control error variance.
 - ii) When we have more than one independent variable we use single factor design.
 - iii) Counterbalancing is used to equate the two groups.
 - iv) Order effect occur in within group design.
 - v) Matched group technique is used in between subject design.
- 2) Fill in the blanks :
 - i) In the within subject design each subject receive treatment.
 - ii) In matched group technique the variable selected for matching should be related to variable.
 - iii) In two randomised group design test is most commonly used.
 - iv) In between subject design we have two groups one is group and other is group.
- 3) Descriptive Question :
 - i) What do you mean by research design ?
 - ii) Discuss in detail the functions of research design ?
 - iii) Discuss with example when to use between subject research design ?
 - iv) When to use within subject research design ? Explain with examples.
 - v) Differentiate between within subject and between subject experimental design.

Answers:

- 1) . (i) T (ii) F (iii) F (iv) T (v) T
- 2) (i) number of (ii) dependent (iii) 't'
(iv) experimental, control

1.8 GLOSSARY

- Independent Variable :** Independent variable is one that cause some change in the value of dependent variable.
- Extraneous Variable :** Independent variable that are not related to the purpose of the study but may affect the dependent variable.
- Experimental Group :** Group in which subject receive treatment.
- Control group :** Subjects in an experiment who do not receive treatment.
- Factor :** The independent variable of an experiment.
- Level :** A particular value of an independent variable.
- Treatment :** Particular set of experimental condition.
- Random assignment :** Unbiased assignment process that gives each subjects an equal chance of being placed in any groups.
- Counterbalancing :** Controlling for order and sequence effect by arranging that subject experience the various condition in different orders.

1.9 SUGGESTED READINGS

Kerlinger, F.N. (2007), “*Foundation of Behavioural Research*” (10th reprint), Delhi, Surjeet publications.

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UNIT 2 FACTORIAL DESIGN

Structure

- 2.0 Introduction
- 2.1 Objectives
- 2.2 Meaning of Factorial Design
- 2.3 Terms Related to Factorial Design
- 2.4 Simple Two Factor Design
 - 2.4.1 Lay Out of Factorial Design
 - 2.4.2 Example of Factorial Design
 - 2.4.3 Representing Interaction in Graphic Form
 - 2.4.4 Importance of Interaction
- 2.5 Types of Factorial Design
 - 2.5.1 Within Subject Factorial Design
 - 2.5.2 Between Subject Factorial Design
 - 2.5.3 Mixed Factorial Design
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- 2.8 Let Us Sum Up
- 2.9 Unit End Questions
- 2.10 Glossary
- 2.11 Suggested Readings

2.0 INTRODUCTION

Research problems are stated in the form of hypothesis. They are stated so that they can be empirically tested. There is a wide range of possibilities of testing hypothesis. There are as many designs of research that exist as there are possibilities. Designs are carefully worked out to yield dependable and valid answers to the hypothesis. The results of the research depends on how the observation and the inferences are made. How dependable our observation and inferences will be, depends on how adequately we plan the research design. The planning of research design depends on the number of independent variables, the number of levels of each independent variable, the kinds of independent variable. If we have one independent variable then we use single factor experimental design. When we have more than one independent variable with more than one level than we use the factorial design. Factorial design may be two factor, three factor, four factor etc. In this unit we will discuss two factor design.

2.1 OBJECTIVES

After reading this unit, you will be able to:

- Define factorial design;
- Describe the terms related to factorial design;

- Formulate factorial design;
- Describe graphically the results of factorial experiment; and
- Identify the advantages and limitations of factorial design.

Traditional research method generally study the effect of one variable at a time because it is statistically easy to manipulate. However in many cases, two factors may be interdependent. One of the most significant developments in modern research design and statistics is, planning and analysis of simultaneous operation and interaction of two or more variables. Variables do not act independently. Rather they often act in concert. There is one design i.e. factorial design by which we can study the effect of more than one independent variable on dependent variable. The factorial designs have the advantage over the single factor design in that interaction of two or more variables can also be studied along with the main effect. In a single factor design the levels of only one factor is varied and the levels of other relevant variable are held constant. Thus the information provided by factorial design is far more complete than provided by single factor design.

2.2 MEANING OF FACTORIAL DESIGN

A factorial design is one in which two or more variable or factors are employed in such a way that all the possible combinations of selected values of each variable are used (McBurney & White, 2007). According to Singh (1998), Factorial design is a design in which selected values of two or more independent variables are manipulated in all possible combinations so that their independent as well as interactive effect upon the dependent variable may be studied. On the basis of the above definition it can be said that the factorial design is one in which two or more independent variables are manipulated in all possible combinations and thus the factorial design enables the experimenter to study the independent effect as well as interactive effect of two or more independent variables.

2.3 TERMS RELATED TO FACTORIAL DESIGN

Factors : The term factor is broadly used to include the independent variable that is manipulated by the investigator in the experiment or that is manipulated through selection. In the research some time it is possible to manipulate the independent variable directly, for example in a study researcher wants to study the effect of different drugs on the recovery of the patient. The researcher may select three dosages 2 mg, 4 mg. and 6 mg. and administer the drug to the subjects. Further researcher may find that age is another important variable that may influence the rate of recovery from the diseases. The second independent variable that is age cannot be directly manipulated by the researcher. The manipulation of the variable 'age' is achieved through selection of the sample. The researcher then may divide the subjects into three age groups.

Main Effect

This is the simplest effect of a factor on a dependent variable. It is the effect of the factor alone averaged across the level of other factors.

According to Mcburney & White (2007) main effect in a factorial experiment, the effect of one independent variable, averaged over all levels of another independent variable.

Interaction : The conclusion based on the main effects of two independent variables may be at times misleading, unless we take into consideration the interaction effect of the two variables also.

According to Mcburney & White (2007) Interaction means when the effect of one independent variable depends on the level of another independent variable. An interaction is the variation among the difference between mean for different levels of one factor over different levels of the other factor. For example a cholesterol reduction clinic has two diets and one exercise regime. It was found that exercise alone was effective and diet alone was effective in reducing cholesterol levels (main effect of exercise and main effect of diet). Also for those patients who didn't exercise, the two diets worked equally well (the main effect of diet); those who follow diet A and exercised got the benefits of both (main effect of diet A & main effect of exercise). However it was found that those patients who followed diet B and exercised got the benefit of both plus a bonus, an interaction effect (main effect of diet B, main effect of exercise plus an interaction effect of diet and exercise).

Types of Interaction

- 1) **Antagonistic interaction :** When main effect is non-significant and interaction is significant. In this situation the two independent variables tend to reverse each others effect.
- 2) **Synergistic interaction :** When higher level of one independent variable enhances the effect of another independent variable.
- 3) **Celling effect interaction :** When the higher level of one independent variable reduces the differential effect of another variable. that is one variable has a smaller effect when paired with higher level of a second variable (Mcburney & White, 2007).

All of these types of interaction are common in psychological research.

Randomisation : Randomisation is the process by which experimental units are allocated to treatment; that is by a random process and not by any subjective process. The treatment should be allocated to units in such a way that each treatment is equally likely to be applied to each unit.

Blocking: This is the procedure by which experimental units are grouped into homogenous cluster in an attempt to improve the comparison of treatment by randomly allocating the treatment within each cluster or block.

2.4 SIMPLE TWO FACTOR DESIGN

In the two factor design we have two independent variables, each of which has two values or levels. This is known as two by two (2x2) factorial design because of the two levels of each variables.

2.4.1 Layout of Factorial Design

2×2 Factorial Design

Factor B	Factor A	
	A_1	A_2
	A_1B_1	A_2B_1
B_2	A_1B_2	A_2B_2

If we have two levels of one variable and three of another variable we would have two by three (2×3) factorial design.

2×3 Factorial Design

Factors B	Factor A		
	A_1	A_2	A_3
	A_1B_1	A_2B_1	A_3B_1
B_2	A_1B_2	A_2B_2	A_3B_2

We may have as many factors and level as we desire but with increasing complexity we will require more time and data become complicated to interpret. Most experiment use two or three factors, with two to six levels on the various factors.

2.4.2 Example of Factorial Design

In an experiment Tulving and Pearlstone (1965) subjects were asked to learn a list of 12, 24 or 48 words (factor A with three levels). These words can be put in pairs by categories (for example apple and banana can be grouped as 'fruits'). Subjects were asked to learn these words and they were shown the category name at the same time as the words were presented. Subjects were told that they did not have to learn the category names. After a very short time, subjects were asked to recall the words. At that time half of the subjects were given the list of the category names, and the other half had to recall the words without the list of categories (factor B with two levels). The dependent variable is the number of words recalled by each subjects is given in the table below:

Table 2.1

	Level of A			Total
	A_1	A_2	A_3	
Levels of B	12 words	24 words	48 words	
B_1 Cued recall	A_1B_1 (10)	A_2B_1 (13)	A_3B_1 (19)	42
B_2 Free recall	A_1B_2 (10)	A_2B_2 (15)	A_3B_2 (29)	54
Total	20	28	48	96

Here we have two independent variables number of words and presence and absence of cues and one dependent variable, that is the number of words recalled by each subject. We could do two separate experiments, one which varied the number of words and the other which varied the presence or absence of cues.

The first experiment could be as in Table 2. This table shows the independent effect of number of words. The second experiments could be as in Table 3.

Table 2.2

Cued Recall

12 Words	24 Words	48 Words
A_1	A_2	A_3

Table 2.3

Free recall

12 Words	24 Words	48 Words
A_1	A_2	A_3

In the above example (Table 2.1) there are six cells into which the sample is divided. Each of the six combination would receive one treatment or experimental condition. Subjects are assigned at random to each treatment in same manner as in a randomised group design. The mean (shown in bracket) for different cells may be obtained along with the means for different rows and columns. Means of different cells represent the mean scores for the dependent variable and the column mean in the given design are termed the main effect for number of words without taking into account any differential effect that is due to the presence or absence cues. Similarly the row mean in the above design are termed the main effect for presence or absence of cues without regard to number of words. Thus through this design we can study not only the main effect of number of words and presence or absence of cues, but we can also study the interactive effect of number of words and presence or absence of cues, on the number of words recalled by the subject.

In this design we have two independent variables, we are able to examine two possible main effects. We found the main effect of number of words by averaging effect of number of words over the two levels of presence and absence of cues when we looked at the column mean. Similarly we found the main effect of presence or absence of categories by averaging the effect of presence or absence of categories over the three levels of number of words when we looked at the row mean.

By these results we can find out the interactive effect. Two variables interact if the effect of one variable depends on the level of the other. We have an interaction here. Because the effect of presence or absence of cues depends on the number of words. Similarly the retention is influence by the length of the test.

Interaction can be presented in a tabular form as well as in graphical form.

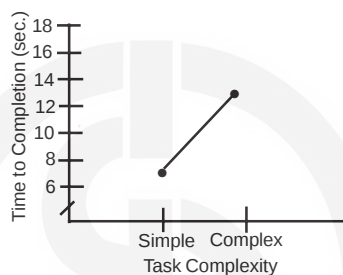
2.4.3 Representing Interaction in Graphic Form

We take the fictitious ons data to present the results in graphic form. One independent variable is task complexity with two levels and second independent variable is level of arousal, that is low arousal and high arousal and the dependent variable is average time (in second) to completion of a task. Result are shown in the Table 2.4.

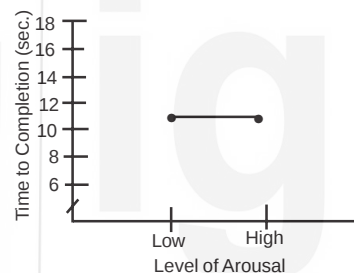
Table 2.4

Study 1	Task Complexity	
High arousal	Simple 7.6	Complex 13.1
Study 2	Level of arousal	
	Low arousal 10.3	High arousal 10.4
Study 3	Task complexity x level of arousal	
	Simple Task	Complex Task
Low arousal	9.0	11.8
High arousal	6.2	14.4

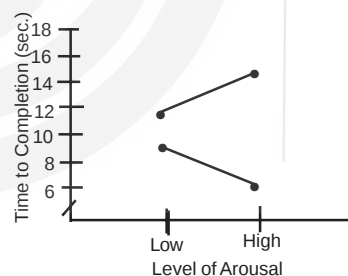
Graphs



a. Study I results



b. Study II results



c. Study III results

The concept of interaction can be understood clearly by looking at the graph rather than the table. The graph for study III shows the interaction between task complexity and arousal. The fact that the two lines on that graph for the simple and complex task groups, are not parallel to one another suggest that there is an interaction. Whenever the lines diverge, converge or even cross whenever they are not parallel the variable interact. If they are parallel, then the relationship between the independent variables is an additive one.

Of course, in an actual research study the lines would rarely be perfectly parallel. There are statistical test that can tell us when they are close enough to parallel to indicate that there is no interaction, as well as when they deviate enough from parallel to indicate that there is an interaction.

2.4.4 Importance of Interaction

Main effect is an average effect. It can be misleading when an interaction is present. When interaction is present we should examine the effect of any factor of interest at each level of the interacting factor before making interpretation (Minimum et.al. 2001). The two factor design is really made up of several one factor experiments. In addition to main effect, the factorial design also allows us to test simple effect.

For example we have 2×2 design. One factor A has two levels A_1 and A_2 and other factor B has two levels B_1 and B_2 . Main effects compare differences among the level of one factor averaged across all levels of the other. However, this particular design consists of four one way experiment and we may analyse each of them separately. We may be interested in effect of A (all two levels) specifically for condition B_2 . Simple effects refer to the results of these one factor analysis. To make such comparison the interaction must first be significant.

Sometimes researcher is more interested in interaction than in a main effect. For example, a study involving two methods and learner of low and high intelligence. Research already established that individual with low intelligence learn more slowly than individuals with high intelligence. The researcher may not be interested in confirming the results, but may be interested to explore whether the relative difference in effectiveness of the two teaching methods is the same for slow learners and for fast learners, that is related to the question about the interaction between method and learning ability. It could be that method and learning ability interact to such a degree that one method is more effective with slow learner and the other is more effective with fast learner.

Self Assessment Questions

- 1) Given below are statement. Indicate whether they are true or false :
 - i) Factorial design is used to study the effect of one independent variable.
 - ii) Interaction effect can be study by single factor design.
 - iii) The independent variables of an experiment is known as factors of the experiment.
 - iv) In within subject factorial design each subject experience each condition.
 - v) The 2×2 design means two independ variables with two levels.
- 2) Fill in the blanks :
 - i) The interaction in which two independent variables tend to reverse each other's effect is known as
 - ii) Interaction in which two independent variables reinforce each other's effect is known as
 - iii) If graphical representation of a variables shows curves that are not parallel line it shows between the variable.
 - iv) The effect of one independent variable averaged over all levels of another independent variable is known as

2.5 TYPES OF FACTORIAL DESIGN

Factorial experiments may be conducted either within subject or between subject. A mixed factorial design is also used in psychology. A mixed factorial design is one that has at least one within subject variable and at least one between subject variable.

2.5.1 Within Subject Factorial Design

In an experiment by Godden & Baddeley (1975), researcher wants to study the effect of context on memory. They hypothesised that memory should be better when the condition at test are more similar to the conditions experienced during learning. To operationalise this idea Godden and Baddeley decided to use a very particular population : deepsea divers. The divers were asked to learn a list of 50 unrelated words either on the beach or under 10 feet of water. The divers were then tested either on beach or under sea. The divers were tested in both the environment in order to make sure that any effect observed could not be attributed to a global effect of one of the environment. The first independent variable is the place of learning. It has 2 levels (on the beach and under sea). The second independent variable is the place of testing. It has two levels (on the beach and under sea). These 2 independent variables gives 4 experimental conditions :

- i) Learning on the beach and recalling on the beach.
- ii) Learning on the beach and recalling under sea.
- iii) Learning under sea and recalling on the beach.
- iv) Learning under sea and recalling under sea.

Each subject in this experiment was tested in all four experimental condition. The list of words was randomly created and assigned to each subject. The order of testing was randomised in order to control the carry over effect. The layout of the within subject factorial design is presented below.

Table 2.5: A within subject factorial design
learning place
A

Testing Place B	Onland A_1	Under Sea A_2
B_1	S_1 S_2 S_3 S_4 S_5 S_6	S_1 S_2 S_3 S_4 S_5 S_6
B_2	S_1 S_2 S_3 S_4 S_5 S_6	S_1 S_2 S_3 S_4 S_5 S_6

2.5.2 Between Subject Factorial Design

A between subject factorial design is presented in the following table. The example is 2×2 design. Separate groups of six experience each condition, thus requiring 24 subjects to get six responses to each of four conditions.

Table 2.6: A between subject factorial design
Factor - A

Factor-B	A ₁	A ₂
B ₁	S ₁	S ₁₃
	S ₂	S ₁₄
	S ₃	S ₁₅
	S ₄	S ₁₆
	S ₅	S ₁₇
	S ₆	S ₁₈
B ₂	S ₇	S ₁₉
	S ₈	S ₂₀
	S ₉	S ₂₁
	S ₁₀	S ₂₂
	S ₁₁	S ₂₃
	S ₁₂	S ₂₄

2.5.3 Mixed Factorial Design

Some time the researcher uses mixed factorial design. Researcher has two independent variable A and B. Variable A is the within subject variable and variable B is the between subject variable. Subject either experiences B₁, once with A₁ and also with A₂; or they experience B₂ once with A₁ and also with A₂.

For example we want to study the effect of gender and alcohol on risk taking while driving. Here we have two independent variables gender (A) and alcohol level (B). Suppose we have decided to operationalise the independent variable 'alcohol level' by having four concentration levels. We decide to have each subject observed in each alcohol condition. The order of administration of each condition will be randomised for each subject. The measures are non repeated for the factor (A) gender and repeated for the factor (B) alcohol level.

Suppose we have 10 subjects 5 males and 5 females. The experimental lay out will be as follows :

Table 2.7

Between Subject Variables	Within Subject Variable			
A	B ₁	B ₂	B ₃	B ₄
A ₁	S ₁	S ₁	S ₁	S ₁
	S ₂	S ₂	S ₂	S ₂
	S ₃	S ₃	S ₃	S ₃

	S_4	S_4	S_4	S_4
	S_5	S_5	S_5	S_5
A_2	S_6	S_6	S_6	S_6
	S_7	S_7	S_7	S_7
	S_8	S_8	S_8	S_8
	S_9	S_9	S_9	S_9
	S_{10}	S_{10}	S_{10}	S_{10}

This example shows a situation in which you would have to use a mixed design.

2.6 ADVANTAGE OF FACTORIAL DESIGN

Factorial design enables the researcher to manipulate and control two or more independent variables simultaneously. By this design we can study the separate and combined effect of number of independent variables.

Factorial design is more precise than single factor design (Kerlinger, 2007).

By factorial design we can find out the independent or main effect of independent variables and interactive effect of two or more independent variables.

The experimental results of a factorial experiment are more comprehensive and can be generalised to a wider range due to the manipulation of several independent variables in one experiment.

2.7 LIMITATION OF FACTORIAL DESIGN

Sometimes especially when we have more than three independent variables each with three or more levels are to be manipulated together, the experimental setup and statistical analysis become very complicated.

In factorial experiments when the number of treatment combinations or treatments become large, it becomes difficult for the experimenter to select a homogeneous group.

2.8 LET US SUM UP

Factorial designs are employed when one wants to study the independent and joint effect of two or more independent variables. There are different types of interaction such as antagonistic, synergistic and ceiling effect. Factorial designs may be conducted as within subject, between subject or they may be used in mixed experiments that have one within subject and one between subject variable.

2.9 UNIT END QUESTIONS

- 1) What do you mean by factorial design. Explain with example.
- 2) Differentiate with illustration the between group factorial design and within subject factorial design.
- 3) Discuss the advantage and limitation of factorial design.

- 4) What do you mean by interaction in factorial design. Discuss various types of interaction.

SAQ ANSWERS :

- 1) i) F ii) F iii) T iv) T v) T
 2) i) antagonistic interaction ii) synergistic interaction
 iii) interaction iv) main effect

2.10 GLOSSARY

- Factorial design** : Research design that involve all combination of at least two values of two or more independent variables.
- Main effect** : The effect of one independent variable averaged over all levels of another independent variable.
- Interaction** : When the effect of one independent variable depends on the level of another independent variable.

2.11 SUGGESTED READINGS

McBurney, D.H. & White, T.L. (2007), “*Research Method 7*” Delhi, Thomson Wadsworth.

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UNIT 3 QUASI EXPERIMENTAL DESIGN

Structure

- 3.0 Introduction
- 3.1 Objectives
- 3.2 Meaning of Quasi Experimental Design
- 3.3 Difference Between Quasi Experimental Design and True Experimental Design
- 3.4 Types of Quasi Experimental Design
 - 3.4.1 Non-Equivalent Group Posttest only Design
 - 3.4.2 Non-Equivalent Control Group Design
 - 3.4.3 The Separate Pretest-post Test Sample Design
 - 3.4.4 The Double Pretest Design
 - 3.4.5 The Switching Replications Design
 - 3.4.6 Mixed Factorial Design
 - 3.4.7 Interrupted Time Series Design
 - 3.4.8 Multiple Time Series Design
 - 3.4.9 Repeated Treatment Design
 - 3.4.10 Counter Balanced Design
- 3.5 Advantages and Disadvantages of Quasi Experimental Design
- 3.6 Let Us Sum Up
- 3.7 Unit End Questions
- 3.8 Glossary
- 3.9 Suggested Readings

3.0 INTRODUCTION

For most of the history of scientific psychology, it has been accepted that experimental research, with its twin assets of random assignment and manipulation of the independent variable by the researcher, is the ideal method for psychological research. Some researchers believe this so strongly that they avoid studying important questions about human personality, sex differences in behaviour, and other subjects that do not lend themselves to experimental research.

A few decades ago researchers in psychology were interested in applied psychology issues conducting research on how students learnt in school, how social factors influenced the behaviour of an individual, how to motivate factory workers to perform at a higher level etc. These research questions cannot be answered by lab experiments as one has to go to the field and the real life situation like the classroom etc., to find answers to the research issues mentioned above. Thus the quasi experimental research came into existence. Quasi-experimental research design can be more easily implemented in natural settings and one can make direct assessment of subjects, find out the effects of a specific treatment introduced by the researcher, and while doing so the researcher can also minimise the influence of extraneous variables. In this unit we will discuss the quasi experimental design.

3.1 OBJECTIVES

After reading this unit, you will be able to:

- Define quasi experimental design;
- Differentiate between quasi experimental and true experimental design;
- Elucidate the different types of quasi experimental design; and
- Enumerate the advantages and disadvantages of quasi experimental design.

3.2 MEANING OF QUASI EXPERIMENTAL DESIGN

The word quasi means ‘as if’ or ‘to a degree’. Thus quasi experimental design is one that resembles an experiment but lacks at least one of its defining characteristics.

According to Mcburney & White (2007) ‘quasi experiment is a research procedure in which the scientist must select subjects for different conditions from preexisting groups’.

According to Broota (1989) “All such experimental situations in which the experimenter does not have full control over the assignment of experimental units randomly to the treatment conditions or the treatment cannot be manipulated are called quasi experimental design.”

According to Singh (1998) “A quasi experimental design is one that applies an experimental interpretation to results that do not meet all the requirement of a true experiment.”

According to Wikipedia, The quasi experimental design are related to the setting up a particular type of an experiment or other study in which one has little or no control over the allocation of the treatment or other factors being studied.

According to Shadish, Cook & Cambell (2002), “The term quasi experimental design refer to a type of research design that lacks the element of random assignment.”

Quasi experimental designs are sometimes called ex-post facto design or after the fact experiment, because the experiment is conducted after the groups have been formed. The independent variable has already occurred and hence, the experimenter studies the effect after the occurrence of the variable. For example if we are interested in gender differences in verbal learning figures we would have to conduct a quasi experiment because we cannot assign participant to the two conditions male and female. We cannot create groups of males and females but instead select members from preexisting groups. In other words, we can say that in quasi experiments we do not manipulate variables but we observe categories of subjects. Matching instead of randomisation is used.

3.3 DIFFERENCE BETWEEN QUASI EXPERIMENTAL DESIGN AND TRUE EXPERIMENTAL DESIGN

In true experimental situation experimenter has complete control over the experiment. In quasi experimental situation, the experimenter does not have control over the assignment of subject to condition.

In true experimental design we manipulate variables but in quasi experimental design manipulation of variable is not possible, we observe categories of subjects. For example, If we want to study the effect of gender then we cannot manipulate gender we simply label groups according to what we think is the important difference between them.

In quasi experimental design we present some independent variables to two preexisting groups. We may not know whether the difference in behaviour was caused by difference between the groups or by the independent variable. A quasi experiment leaves open the possibility that other differences exist between the experimental and control conditions and thus permit other potential differences to remain.

Self Assessment Questions

- 1) Given below are statement, state whether statement are true or false :
 - i) Trait anxiety is a quasi experimental variable.
 - ii) Quasi experimental design have high internal validity.
 - iii) Quasi experiment may be performed when a true experiment would be impossible.
 - iv) In quasi experiment there is lack of random assignment of subjects in groups.
 - v) These design are not useful in psychological research.
- 2) Fill in the blanks :
 - i) It is possible to subjects to conditions in a true experiment, in a quasi experiment it is necessary to subject from preexisting groups.
 - ii) The validity of a quasi experiment is higher than true experiment.
 - iii) The research design that allows the same group to be compared over time to known
 - iv) In multiple time series design we have groups.
 - v) Manipulation of independent variable is made by in quasi experimental design.
- 3) Descriptive question :

Answers:

- 1) (i) T (ii) F (iii) T (iv) T (v) F
- 2) (i) assign, select (ii) external (iii) time series design (iv) two (v) selection

3.4 TYPES OF QUASI EXPERIMENTAL DESIGN

There are many different types of quasi experimental designs that have a variety of applications in specific context. Here we will study some important quasi experimental designs.

3.4.1 Non-Equivalent Group, Posttest only Design

The non-equivalent, posttest only design consists of administering an outcome measure to two groups or to a program/treatment group and a comparison. For example, one group of students might receive reading instruction using a whole language program while the other group of students receives a phonetics based program. After twelve weeks, a reading comprehension test can be administered to see which program was more effective.

A major problem with this design is that the two groups might not be necessarily the same before any instruction takes place and may differ in important ways that influence what reading progress they are able to make. For instance, if it is found that the students in the phonetics groups perform better, there is no way of determining if they are better prepared or better readers even before the program and/or whether other factors are influential to their better performance.

3.4.2 Non-Equivalent Control Group Design

In this design both a control group and an experimental group is compared. However the groups are chosen and assigned out of convenience rather than through randomisation. The problem with this design is in determining how to compare results between the experimental and control group. For example, we are interested to study the effect of special training programmes, on the grade point average of 10th grade students. The experimenter could not draw random sample as the school will not permit the experimenter to regroup the classes. Therefore researcher selected two sections of X grade from the same school. Because the subjects were not randomly allocated to the two groups we cannot say that groups are equivalent before the experimental manipulation was performed. We find out the grade point at the start of the programme and then again after the program. The group who does not receive treatment (training) is our control group.

This design may be diagrammed as shown below :

G_1	O_1	O_2
G_2	O_3	O_4

O = Observation

X = Treatment or experimental variable

Here we cannot say whatever difference we find in the grade point of two groups is because of training programme or because of some other confounding variable. It is possible that the student of one section who participate in training programme were inherently different in terms of motivation abilities, intelligence from those who did not participate.

3.4.3 The Separate Pretest -Posttest Sample Design

The basic idea in this design is that the people we use for the pretest are not the same as the people we use for posttest. The design may be diagrammed as shown below :

G_1	0	
G_1	X	0
G_2	0	
G_2		0

There are four groups but two of these one groups come from a single non equivalent group and the other two also come from other single non equivalent group. For example let us say, you have two organisations that you think are similar. You want to implement your study in one organisation and use other as a control. You design a program to improve customer satisfaction. Because customers routinely cycle through your organisation, you cannot measure the same customer pre-post. Instead you measure customer satisfaction in each organisation at one point in time, then implement your program and then once again measure customer satisfaction in the organisation at another point in time after the program. Here the customers will be different within each organisation for the pre-test and post-test. Here we cannot match the individual participant responses from pre to post. We can only look at the change in average customer satisfaction. Here non equivalence exists not only between the organisations but that is within organisation the pre and post groups are non-equivalent.

3.4.4 The Double Pre-Test Design

This is a very strong quasi experimental design with respect to internal validity. Because in pre-post non-equivalent group design the non-equivalent groups may be different in some way before the program is given and we may incorrectly attribute post-test differences to the program. Although the pre-test helps to assess the degree of pre-program similarity, it does not tell us if the groups are changing at similar rates prior to the program.

The double pre-test design includes two measures prior to the program. Consequently if the program and comparison group are maturing at different rates we can detect this as a change from pretest 1 to pretest 2. Therefore this design explicitly controls for selection maturation threats.

3.4.5 The Switching Replications Design

The Switching Replications quasi-experimental design is also very strong with respect to internal validity. And, because it allows for two independent implementations of the program, it may enhance external validity or generalisability. The design has two groups and three phases of measurement.

In the first phase of the design, both groups are pretested, one is given the program and both are post-tested.

In the second phase of the design, the original comparison group is given the program while the original program group serves as the “control”. This design is identical in structure to its randomised experimental version, but lacks the random assignment to group. It is certainly superior to the simple pre-post non-equivalent groups design.

3.4.6 Mixed Factorial Design with one Non-Manipulated Variable

This design can be explained by an experiment. In an experiment Edmund Keogh and Gerke Witt (2001) hypothesise that caffeine intake might influence the perception of pain and that the effect may be different in men and women. 25 men and 25 women took part in two sessions separated by a week. In one session the participants drank a cup of coffee that contained caffeine and in the other session, they drank decaffeinated coffee. In both the sessions the participants put their non dominant hand in ice water bath and to indicate the point of just noticeable pair.

Design of the Study		
Gender	Coffee Beverage	
	Decaffeinated	Caffeinated
Women	S_1	S_1
	S_2	S_2
Men	S_{25}	S_{25}
	S_{26}	S_{26}
	S_{27}	S_{27}
	S_{50}	S_{50}

The above is a mixed factorial design because it has one between subject variable (gender) and one within subject variable (caffeine).

3.4.7 Interrupted Time-Series Designs

These are the research designs that allow the same group to be compared over time by considering the trend of the data before and after experimental manipulation. (McBurney & White, 2007).

In this design pre-testing and post-testing of one group of subject is done at different intervals. In the time series design, the purpose might be to determine the long term effect of treatment and therefore the number of pre-test and post-test can vary from one each to many. Sometimes there is an interruption between tests in order to assess the strength of treatment over an extended time period. This design can be diagrammed as below :

$$O_1 \ O_2 \ O_3 \ O_4 \ X \ O_5 \ O_6 \ O_7 \ O_8$$

The above diagram shows that a series of pre-tests are given to a group. Then treatment (X) is given and a series of post-tests are given to the same subject. This design is different from single group pretest posttest design. In this we give the series of pretests and posttests to a subject, where as in the pre test post test design we give only single pretest and posttest.

3.4.8 Multiple Time Series Design

In this design we have two groups, one group receives treatment and the other group does not receive the treatment and this group acts as the control group.

This design can be presented as given in the diagram below :

Pre response measure	Treatment	Post response measure
$G_1 O_1 O_2 O_3 O_4 O_5$	X	$O_6 O_7 O_8 O_9 O_{10}$
$G_2 O_1 O_2 O_3 O_4 O_5$		$O_6 O_7 O_8 O_9 O_{10}$

It is usually a complex setting with many events and trends that might affect the behaviour in question. The addition of a comparison group for which the same series of measures is available, but which is not exposed to the treatment whose effects are being studied, can be useful in clarifying the relationship between the treatment and any change in the series of behavioural measures being used.

3.4.9 Repeated Treatment Design

Repeated treatment design is one in which a treatment is withdrawn and then presented the second time (McBurney and White, 2007).

In this design the treatment is presented more than once. The subject's response is measured before and after the introduction of a treatment, then the treatment is withdrawn and the whole process is began again. The design is shown in following table

Table : A Repeated treatment design

Pretest ₁	Treatment	Posttest ₁	Withdraw	Treatment	Pretest ₁	Posttest ₂
----------------------	-----------	-----------------------	----------	-----------	----------------------	-----------------------

Repeated treatment design can be explained with the help of a study of the effect of a ban on alcohol consumption in a small community, let us say the Toda Community in Tamil Nadu. Let us assume that the government has put a ban on alcohol consumption as it is detrimental to the health of the workers in that area. To assess the impact of alcohol policy changes on the productivity of the workers, medical problems related to alcohol consumption etc., were studied. The results indicated that the productivity improved as a result of this ban amongst the community persons.

3.4.10 Counter Balanced Design

Such designs are also called cross-over design (Cochran & Cox, 1957). The name counter balance was given by Underwood (1949). In this design the experimental control is achieved by randomly applying experimental treatment. Here each treatment appears once and only once in each column and in each row. A counter balance design in which four treatment have been randomly given to four groups on four different occasion is given below :

Group-A	X_1	X_2	X_3	X_4	0
Group-B	X_2	X_4	X_1	X_3	0
Group-C	X_3	X_1	X_4	X_2	0
Group-D	X_4	X_3	X_2	X_1	0

Variables like maturation, selection and experimental mortality posing threats to internal validity are well controlled by the counter balance design.

3.5 ADVANTAGES AND DISADVANTAGES OF QUASI EXPERIMENTAL DESIGN

Advantages

In social science, where pre selection and randomisation of groups is often difficult, they can be very useful in generating results for general trends.

E.g. if we study the effect of maternal alcohol use when the mother is pregnant, we know that alcohol does harm embryos. A strict experimental design would include that mothers were randomly assigned to drink alcohol. This would be highly illegal because of the possible harm the study might do to the embryos.

So what researchers does is to ask people how much alcohol they used in their pregnancy and then assign them to groups.

Quasi-experimental design is often integrated with individual case studies; the figures and results generated often reinforce the findings in a case study, and allow some sort of statistical analysis to take place.

In addition, without extensive pre-screening and randomisation needing to be undertaken, they do reduce the time and resources needed for experimentation.

Since quasi-experimental designs are used when randomisation is impossible and/or impractical, they are typically easier to set up than true experimental designs.

Utilising quasi-experimental designs minimises threats to external validity as natural environments do not suffer the same problems of artificially as compared to a well-controlled laboratory setting.

Since quasi-experiments are natural experiments, findings in one may be applied to other subjects and settings, allowing for some generalisations to be made about population.

This experimentation method is efficient in longitudinal research that involves longer time periods which can be followed up in difference environments.

Quasi-experimental design is often integrated with individual case studied; the figures and results generated often reinforce the findings in a case study, and allow some sort of statistical analysis to take place.

In addition, without extensive pre-screening and randomisation needing to be undertaken, they do reduce the time and resources needed for experimentation.

Disadvantages

Without proper randomisation, statistical tests can be meaningless.

A quasi experiment constructed to analyse the effects of different educational programs on two groups of children, for example, might generate results that show that one program is more effective than the other. These results will not stand up to rigorous statistical scrutiny because the researcher also needs to control other factors that may have affected the results.

The lack of random assignment in the quasi experimental design method may allow studies to be more feasible, but this also poses many challenges for the investigator in terms of internal validity. This deficiency in randomisation makes it harder to rule out confounding variables and introduces new threats to internal validity.

Because randomisation is absent, some knowledge about the data can be approximated, but conclusions of causal relationships are difficult to determine due to a variety of extraneous and confounding variables that exist in a social environment.

Moreover, even if these threats to internal validity are assessed, causation still cannot be fully established because the experimenter does not have total control over extraneous variables.

Thus one may conclude that disadvantages aside, as long as the shortcomings of the quasi experimental design are recognised, these studies can be a very powerful tool, especially in situations where 'true' experiments are not possible.

These are very useful to obtain a general overview and then follow up with a case study or quantitative experiment so as to focus on the underlying reasons for the results generated. They are very useful methods for measuring social variables.

3.6 LET US SUM UP

Quasi experiments may be performed when a true experiment is not possible. The main difference between true experimental design and quasi experimental design is random assignment of subject in groups. In quasi experimental design researcher does not have control over the assignment of subject to condition. There are different types of quasi experimental design. Some design involve two groups and other have single group. Some commonly used quasi experimental designs are non equivalent control group design, the separate pretest protest design, the double pretest design, mixed factorial design, interrupted time series design, multiple time series, design etc., repeated treatment design etc. The main advantage of quasi experimental design is that these can be used when randomisation of the group is impossible and or impractical. Because of the lack of random assignment the internal validity of quasi experimental design is very low. In these design there are possibility of selection bias because the participant are not randomly assigned.

3.7 UNIT END QUESTIONS

- 1) Define and describe the quasi experimental design.
- 2) Differentiate between true experimental design and quasi experimental design.
- 3) Discuss with example the non equivalent control group design.
- 4) What are the various types of quasi experimental designs.

3.8 GLOSSARY

Quasi experiment	: Research procedure in which the scientist must select subjects for different conditions from preexisting groups.
Non-equivalent control group design	: Research design having both an experimental and a control group wherein subjects are not randomly assigned to group.
Counter balance design	: The design in which each treatment appears once and only once in each column and row.
Interrupted time series design	: Research design that allows the same group to be compared over time by considering the trend of the data before and after experimental manipulation.

3.9 SUGGESTED READINGS

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UNIT 4 OTHER DESIGNS

(CORRELATIONAL DESIGN AND COMPARATIVE DESIGN)

Structure

- 4.0 Introduction
- 4.1 Objectives
- 4.2 Definition of Correlational Research Design
- 4.3 Types of Correlational Research Design
- 4.4 Evaluation of Correlational Design
 - 4.4.1 Advantages
 - 4.4.2 Disadvantages
- 4.5 What are the Standard of Quality Used when Assessing Correlational Design
- 4.6 Causal Comparative Research Design
- 4.7 Comparison Between Causal-Comparative and Correlational Designs
 - 4.7.1 Similarity
 - 4.7.2 Differences
- 4.8 Comparison Between Causal Comparative and Experimental Design
- 4.9 Data Analysis for Causal Comparative Research Design
- 4.10 Evaluation of Causal Comparative Research Design
 - 4.10.1 Advantages
 - 4.10.2 Limitation
- 4.11 Let Us Sum Up
- 4.12 Unit End Questions
- 4.13 Glossary
- 4.14 Suggested Readings

4.0 INTRODUCTION

The experimental designs which we discussed in first two units provide the most powerful means of studying the behaviour. As you know the important features of experimental design is manipulation of independent variable and control over the experiment. The researcher has enough control over the situation to decide which participant receives which condition at which time. Sometimes the researchers are interested in some variables which cannot be manipulated by the experimenter, where researcher does not have control over the who, what, when, where and how. For example if we are interested to study:

- a) Whether scholastic achievement depended upon the general intelligence of a child?
- b) Does there exist gender difference in aggression?
- c) Is there any relationship between the size of the skull and the general intelligence of the individual?

Many such questions may arise from time to time for which we may try to find answers through research. To answer such research questions we have to use

non-experimental research design. The most commonly used non-experimental research designs are correlational research design and causal comparative research design. Correlational research design involves correlation between two variables and causal comparative research design involves comparing two groups in order to explain existing differences between them on some variable or variables of interest. In this unit we will learn about correlational research design and causal comparative research design.

4.1 OBJECTIVES

After studying this unit, you will be able to:

- Define correlational design;
- Enumerate the types of correlational design;
- Describe the advantages and limitations of correlational design;
- Define causal comparative design;
- Differentiate between causal and correlation designs; and
- Enumerate the advantages and limitations of causal comparative design.

4.2 DEFINITION OF CORRELATIONAL RESEARCH DESIGN

Correlational research designs are founded on the assumption that reality is best described as a network of interacting and mutually causal relationship. Everything affects and is affected by everything else. This web of relationship is not linear. Thus, the dynamics of a system, that is how each part of the whole system affects each other part is more important than causality. The correlational investigations attempt to compare the level of one variable with those of another to see if a relationship exists between the two. The correlational design is a quantitative design.

According to Singh, (1998), Correlational design is one in which the researcher collects two or more sets of data from the same group of subjects so that the relationship between the two subsequent sets of data can be determined.

Correlational research design is one which studies relationship among variables, none of which may be the actual cause of the other (McBurney & White, 2007).

On the basis of above definitions it can be stated that correlational design is one which have two or more quantitative variables from the same group of subjects and which shows the relationship between the two variable.

The correlational design may be diagrammed as follows :

X1	X2
O1	P1
O2	P2
O3	P3
.	.
.	.
.On	Pn

The relationship indicated by the symbol r will be the relationship between the observations ($O_1 \dots O_n$) of X_1 and ($P_1 \dots P_n$) of X_2

4.3 TYPES OF CORRELATIONAL RESEARCH DESIGN

Correlational designs can be broadly categorised in two broad divisions:

- 1) Those that measure the degree of association between variables and (2) Those that are used to Predict the score on one variable using knowledge about the one or more variables.

Within the former, that is those that measure the degree of association between variables, we have (a) Association between two variables and (b) Association amongst more than 2 variables. These are being presented below.

For example let us say a researcher wants to study the relationship between academic stress and academic achievement of college students. For this let us say that the researcher randomly selects 100 college students and administers the measure of academic stress and subsequently a test of academic achievement. Thus the researcher will have two sets of data.

a) Association between two variables

A correlation coefficient can be calculated from those 100 pairs of numbers. Theoretically it could take a positive or negative absolute value between -1.00 to 0.00 to +1.00. The larger the coefficient, whether positive or negative, the more consistent the relationship between the two variables.

If the coefficient takes a positive value it means the individual who is higher on one variable (X_1) will higher on second variable (X_2). This is sometimes referred to as a *direct relationship*. If the coefficient takes a negative value between 0 and -1.00, it would indicate that those who have obtained higher scores on X_1 will have lower scores on X_2 . In our above example if the correlation is negative it means that those who scored high on academic stress will have low academic achievement. This is some time referred to as an *inverse relationship*.

b) Association between more than two variables

So what if academic stress and academic achievement have significant correlation ? And what if study habits, intelligence and other factors were also associated with academic achievement. We could measure the association between all these variables in the same group of children. We administer tests for the measurement of study habit and intelligence and obtain scores on the same group of subjects and find out the multiple correlation.

- 2) Those that are used to predict the score on one variable using knowledge about the one or more variables.

If there is a correlation between two variables, and we know the score on one, the second score can be predicted. In this type of situation there are two variables, one variable that is used to make a forecast about an outcome is known as *predictor variable* and the other variable, is what we are trying to predict is known as *criterion variable*.

By way of regression analysis we can make this prediction. For example there is a relationship between stress and health. If we know the stress score, by way of regression analysis we can predict the future health status score.

Some time the researchers have more than one predictor variable and one criterion variable. The combination gives us more power to make accurate predictions. for example if we have stress scores as well as health behaviour score and past health score then one can make more accurate prediction of health status. Here we have three predictors, stress, health behaviour and previous health status and one criterion variable future health.

4.4 EVALUATION OF CORRELATIONAL DESIGN

The advantages and disadvantages of the correlational designs are presented in the following section. First we deal with advantage and then the disadvantages.

4.4.1 Advantages

The correlational designs are used in many cases because available data makes it easy to use. Some more careful researchers use the result of correlational studies to formulate new hypothesis which they can test later using more rigorous research design rather than test hypothesis about cause and effect directly.

Correlational design is used as the foundation for other designs that permit more certain causal inferences to be drawn from results.

It usually does not involve repeated administration of a behavioural measure, thus avoiding pretest sensitisation.

It usually uses very realistic measurements of behaviour and its possible causes as well.

Correlational research thus avoids the problem of non-representative research context. It also permits the use of large carefully chosen sample thus avoiding the threat of non representative sample of participant.

4.4.2 Disadvantages

The major disadvantage of correlational designs is that they leave the actual reason for the association found quite unclear. For example there is a positive correlation between exposure to violent program on television and violence on the playground. If we find the correlation rather positive and high, we may be tempted to conclude that exposure to violent television causes children to be aggressive and violent. But such a conclusion is completely unwarranted.

Rarely does a correlational study allow inferences about cause and effect. In this case, there are many other possible explanations for the relationship. For example, perhaps children with parents who neglect and physically abuse them just pop them in front of the TV at night, when the violent shows tend to be on. These children may have learned from the parent's abuse and neglect, that aggression and violence are acceptable ways of relating to others, and so they do it on their own around their classmates. In such a case, the obtained association between exposure to violent television and actual violent behaviour may be spurious. That is, a third variable parental neglect and abuse cause them both.

Another possible explanation is that children who tend to be violent, for whatever reason, tend to prefer watching violent television shows. It is not that the violent television causes the violent behaviour. Instead, some children are dispositionally violent (that is, due to personality or genetics also other variables) and it is this that determines both the preference for violent TV shows and the playground aggressiveness.

Correlational designs have directional problem. The causation is reversed from the expected direction. The designation of one of the variables as the independent variable and one as the dependent variable is arbitrary, compared to a true experiment, in which the independent variable is manipulated by the researcher. Children may watch violent television program because they behave aggressively rather than the other way round. Television program may validate their choice of activities by showing others who do the same, or children may watch to learn more about how to behave violently.

Hence, the internal validity of the correlational design is very low.

4.5 WHAT ARE THE STANDARD OF QUALITY USED WHEN ASSESSING CORRELATIONAL DESIGN

Researchers must choose the variables to use within a correlational analysis with great care. A sound theory that takes alternative explanations into account should be used to determine which variables are of immediate interest.

Correlation is based on the assumption that the variables in question are related linearly and do not suffer from multicollinearity.

Care must be taken to ensure that artificially restricted distributions, missing data, and deviant cases or outliers are addressed.

Correlational studies can be made more powerful by using statistical techniques that themselves allow for the partial control of third variables, when those variables can be measured. Correlational statistics such as hierarchical multiple regression, path analysis, and structural equation modeling all fall into this category. These statistics, in essence, allow the correlation between two variables to be recalculated after the influence of other key variables are removed. Thus these types of correlational statistics and designs help to rule out certain causal hypotheses, even if they cannot demonstrate the true causal relation definitely.

The most important thing to look for in a correlational study, when determining its validity, is the controls that the researcher puts into place to control the extraneous variables influence.

4.6 CAUSAL COMPARATIVE RESEARCH DESIGN

There are many occasions while conducting research in psychology, where the researcher is unable to control the independent variable. Or it may be that the researcher finds it rather unethical to control the independent variable, or it could also be that it is too difficult to control the independent variable. To cite an example, let us say that the researcher wants to study “the effect of gender on aggression”, here the independent variable is gender and dependent variable is

aggression. Researcher cannot manipulate independent variable i.e. gender. Another example is that if the researcher is interested in studying the effect of diet (vegetarian V/s. non-vegetarian) on mental health, here again the independent variable which is cannot be manipulated, as it is unethical to manipulate the diet from vegetarian to non vegetarian as there are people who are purely vegetarians. In these types of situation the researcher uses a causal comparative research design rather than an experimental design for the research.

The basic design of a causal-comparative research study is to select a group that has the independent variable (the experimental group) and then select another group of subjects that does not have the independent variable (the control or comparison group). The two groups are then compared on the dependent variable. For example, in school, some of the seventh grade math classes use hand held calculators. We want to find the effect of calculator use on mathematics grades at the end of the year. So we select a group of students from the classes which use calculators and then select another group of the same size from the classes who do not use calculators and then compare the two groups at the end of the year on their final math grades. Another variant of this study would be to take the students from one class that uses calculators and compare them with another class that does not use calculators. Both these studies would be causal comparative research studies.

Instead of using an experimental group and a control group as in the study considered above, we could have a causal comparative research study in which two or more groups differ in some variable that constitutes the independent variable for the study. For example in a study researcher might wish to compare students at four different age levels (or grade levels) on their amount of participating in extra-curricular activities. The researcher could look at the number of extra-curricular activities participated in by four groups of students. The first group would be students in grades 1-3, the second group students in grades 4-6, the third group students in grades 7-9, and the fourth group students in grades 10-12. The independent variable in this study would be grade placement and the dependent variable would be participating in extra-curricular activities. Thus the research would focus on the effect of grade levels on participation in extra-curricular activities for public school students grades 1-12.

Causal comparative research attempts to identify a causative relationship between an independent variable and a dependent variable. However this relationship is more suggestive than proven as the researcher does not have complete control over independent variable.

Causal comparative design compares two or more groups on one variable. Causal comparative design is used to determine the cause for or consequences of existing differences in groups of individuals. For example the researcher may be interested in finding out the differences in performances of students taught by inquiry teaching method and by lecture teaching method.

Self Assessment Questions

- 1) Given below are statements, state whether statement are true or false :
 - i) Correlational design is a quantitative design of research.
 - ii) Causal comparative research design is an experimental design.

- iii) Correlational design avoids the threat of non-representative sample of participation.
- iv) Causal comparative research design attempt to identify a causative relationship between an independent variable and dependent variable.
- v) In causal comparative design researcher manipulate the independent variable.

2) Fill in the blanks :

- i) Correlational design studies the between the variables.
- ii) Coefficient of correlation expresses the and of relationship between the variables.
- iii) Causal comparative research looks at between the groups.
- iv) Correlational design and causal comparative design both are research design.
- v) When it is possible to manipulate the independent variable then we use design.

Answers:

- | | | | | |
|--------------------|-----------------------|--------|-------|------|
| 1) i) T | ii) F | iii) T | iv) T | v) F |
| 2) i) relationship | ii) degree, direction | | | |
| iii) comparison | iv) non-experimental | | | |
| v) experimental | | | | |

4.7 COMPARISON BETWEEN CAUSAL-COMPARATIVE AND CORRELATIONAL DESIGNS

4.7.1 Similarity

Both are non-experimental methods because they lack manipulation of an independent variable which is under the control of the experimenter and hence in both the cases, random assignment of participants is not possible. This means among other things the variable must be observed as they occur in the natural setting.

In both the designs, techniques used for controlling confounding variables is the same. In both the methods matching or quota sampling techniques are used to control confounding extraneous variables.

In both the research the most common type of independent variable used are called attribute variable (Kerlinger, 1986). They cannot be manipulated by the researcher, they represent characteristics or attributes of different persons.

Like correlational research, causal comparative research is sometimes treated as a type of descriptive research since it too describes conditions that already exist.

4.7.2 Differences

Causal comparative research involves comparing two groups in order to explain existing differences between them on some variables of interest. In causal comprehensive research the groups being compared have already been formed and if any treatment (if there was a treatment), it also has already been applied.

Correlational research on the other hand does not look at differences between groups. Rather it looks for relationship within a single group.

Causal comparative research compares groups but the correlational research looks at one group having nothing to do with establishing evidence of causality.

In correlational research some, independent variable is labelled as predictor variable but not in causal comparative research.

Both designs differ on the scaling of the independent and/or dependent variables. Causal comparative researches include at least one categorical variable. The correlational research includes only quantitative variables. i.e. intelligence, attitude, age, income, job satisfaction etc.

4.8 COMPARISON BETWEEN CAUSAL COMPARATIVE AND EXPERIMENTAL DESIGN

Causal comparative and experimental research both attempt to establish cause effect relationship and both involve comparison. But there are difference between two methods.

In experimental design researcher select a random sample and then randomly divide the sample into two or more groups. Groups are assigned to the treatment and the study is carried out.

In causal comparative design individuals are not randomly assigned to treatment groups because they already were assigned into groups before the research began.

In experimental research the independent variable is manipulated by the researcher whereas in causal comparative research the groups are already formed and already different on the independent variable. Independent variable in causal comparative cannot be manipulated by the researcher.

4.9 DATA ANALYSIS FOR CAUSAL COMPARATIVE RESEARCH DESIGN

An inferential statistic used in both causal comparative and experimental research designs is the t-test. Where the subjects in the two groups are independent of one another, that is no matching of subjects or other control procedures were used, the independent t-test is used to test the significance of a difference between the means of the two groups in the study.

In research designs where the influence of an extraneous variable has been controlled, or in designs utilising a pre-test-post-test procedure, the appropriate t-test to use to compare the two group would be the dependent t-test.

When we have three or more groups to compare, the appropriate inferential statistic to use would be one-way analysis of variance. This statistics shows the significance of differences in the means of three or more groups of subjects.

In cases where we are using frequency counts for the dependent variable, the appropriate inferential statistic to use would be the chi-square test. This statistic tests the significance of differences between two or more groups (independent variable) in frequencies for the dependent variable. For example, a high school social studies teacher wants to see if the major party political affiliation for students is similar to or different from that of the registered voters in the country where the high school is located. The teacher would ask the students (anonymously) to indicate whether they would support the democratic party or the republican party. The proportion of students selecting the democratic or republican parties would be compared with the country's proportions of democratic and republican voters.

4.10 EVALUATION OF CAUSAL COMPARATIVE RESEARCH DESIGN

4.10.1 Advantage

For the behavioural science causal comparative research is more fruitful than experimental study. Because there are number of organismic variables such as age, gender etc. cannot be manipulated by the researcher similarly sometime the nature of the independent variable is such that it may cause physical or mental harm to participants if it is manipulated by the researcher. For such type of variables the causal comparative research design is more fruitful.

Experimental studies are more costly than causal comparative studies. Causal comparative studies help to identify variable worthy of experimental investigation.

Causal comparative research do permit investigation of variables that cannot, or should not be investigated experimentally, facilitate decision making, providing guidance for experimental studies and are less costly on all dimensions.

But despite many key advantages causal comparative research does have serious limitation.

4.10.2 Limitation

Since the independent variable has already occurred the same kind of control cannot be exercised as in experimental study.

In causal comparative research manipulation of independent variable is not done by the researcher, the alleged cause of an observed effect may in fact be the effect itself, or there may be third variable that influence both cause and effect. For example a research hypothesised that self concept is a determinant of reading achievement. For this researcher administered a self concept test on a group of subjects and identify two groups with one group having high self esteem and one group having low self esteem. If the high self esteem group shows high reading achievement, we conclude that self esteem influence reading achievement. Here it is difficult to establish whether self esteem causes achievement or vice versa. Because both the independent variable and dependent variable would have already occurred, it would not be possible to determine which came first. It

would be possible that some third variable, such as parental attitude might be the main influence on self esteem and achievement. Therefore caution must be exercised in attributing cause effect relationship based on causal comparative research.

In causal comparative research the researcher cannot assign participant to treatment groups because they are already in those groups.

One of the problems with causal comparative research is that since the pupil are not randomly placed in the groups, the groups can differ on other variables that may have an effect on the dependent variable. In experimental research we can assume that these other variables cancel out among the study groups by the process of randomisation.

4.11 LET US SUM UP

The correlational designs are used when we have two or more quantitative variables from the same group of subjects and we are interested to determine if there is a relationship between two variables. Correlation does not show a causal relation, it can be used for prediction.

Causal comparative design compare two or more groups on one variable. This design does permit investigation of variables that cannot or should not be investigated experimentally. Correlational design and causal comparative design both are non-experimental designs. But one studies the relationship between variables and the other studies the difference between variables.

4.12 UNIT END QUESTIONS

- 1) When to use correlational and causal comparative research design.
- 2) Write down the advantage and limitation of correlational design.
- 3) What are the similarities and differences between correlational and causal comparative research.
- 4) What are the advantage and limitation of causal comparative design.

4.13 GLOSSARY

Correlational design	: Correlational research design is one which studied relationship among variables none of which may be the actual cause of other.
Coefficient of correlation	: Degree and direction of relationship among variables. The coefficient of correlation usually expressed as number between -1 to +1.
Causal comparative design	: Research design compare two or more groups on one variable.

4.14 SUGGESTED READINGS

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UNIT 1 INTRODUCTION INCLUDING ETHNOGRAPHY

Structure

- 1.0 Introduction
- 1.1 Objectives
- 1.2 Meaning of Qualitative Research
- 1.3 Types of Qualitative Research
- 1.4 Qualitative and Quantitative Research: A Comparison
- 1.5 Relevance of Qualitative Research in Psychology
- 1.6 Ethnography: The Meaning
- 1.7 Some Common Terms Used by Ethnographers
- 1.8 Assumptions in Ethnography
- 1.9 Types of Ethnographic Research
- 1.10 Purpose of Ethnographic Research
- 1.11 Steps of Ethnographic Method
- 1.12 Ethical Guidelines in Qualitative Research
- 1.13 Let Us Sum Up
- 1.14 Unit End Questions
- 1.15 Suggested Readings and References

1.0 INTRODUCTION

The unit deals with the basic concepts, implications and uses of qualitative research in psychology. The unit also tries to introduce and describe the meaning and essence of 'ethnography' in qualitative research. It provides the meaning and types of qualitative research. Comparing qualitative with quantitative research, the unit puts forward the relevance of qualitative research in the field of psychology. In this unit, the various methods of ethnographic research are presented. The ethical guidelines in qualitative research.

1.1 OBJECTIVES

After reading this unit, you will be able to:

- define qualitative research;
- differentiate between qualitative and quantitative research;
- explain different types of qualitative research;
- describe the relevance of qualitative research in psychology; and
- explain the concept and importance of ethnography in qualitative research.

1.2 MEANING OF QUALITATIVE RESEARCH

Qualitative research can be defined as a type of scientific research that tries to bridge the gap of incomplete information, systematically collects evidence, produces findings and thereby seeks answer to a problem or question. It is widely used in collecting and understanding specific information about the behaviour, opinion, values and other social aspects of a particular community, culture or population. An example of a qualitative research can be studying the concepts of spiritual development amongst college students. David (1995) had done such a study at a fairly conservative school. He actually tried to analyse whether there is uniformity or considerable diversity in people's understanding of spiritual development or not.

Qualitative research helps in providing an in depth knowledge regarding human behaviour and tries to find out reasons behind decision making tendencies of humans.

1.3 TYPES OF QUALITATIVE RESEARCH

Attempting to understand human nature, market research purposes, current trends, changing tastes and preferences of people, there are certain approaches of qualitative research. They are:

- i) **Case study:** With the help of this method a case of an individual, group, event, institution or society is studied. It helps in providing an in depth knowledge of the nature, process or phenomena of a specific case under study. Multiple methods of data collection are often used in case study research (example, interviews, observation, documents, and questionnaires). The final report of the case study provides a rich (i.e., vivid and detailed) and holistic (i.e., describes the whole and its parts) description of the case and its context.
- ii) **Ethnography:** This approach mainly focuses on a particular community. It is more of a kind of closefield observation and basically tries to study a socio cultural phenomena. For example, judging others based on the researchers' cultural standards. Ethnography can be used for comparative analysis of cultural groups (e.g. eating habits of North Indians and South Indians), also known 'Ethnology'. Further it can also be used to analyse the cultural past of group of people (e.g. Harrapan civilisation), also known as 'Ethnohistory'.
- iii) **Historical method:** This method helps in understanding and analysing the causal relationships. With the help of this technique, the data related to the occurrence of an event is collected and evaluated in order to understand the reasons behind occurrence of such events. It helps in testing hypothesis concerning cause, effects and trends of events that may help to explain present events and anticipate future events as well.
- iv) **Grounded theory:** This approach involves an active participation of the researcher in the activities of the group, culture or the community under study. The data regarding the required information is collected with the help of observation. It is generally used in generating or developing theories. This means that the ground theorists can not only work upon generation of new theories, they can test or elaborate previously grounded theories.

Four important characteristics of a grounded theory are:

- i) **Fit:** It helps in analysing whether the theory corresponds to real existing community
- ii) **Understanding:** The theory generated by grounding is clear and understandable
- iii) **Generality:** The theory provides much information and scope for further analysis or generating more theories.
- iv) **Control:** The theory generated is valid as it has been analysed under controlled conditions.

Functions of Grounded Theory

- i) It helps in identifying anchors or codes that allow the key points of the data to be gathered
- ii) It helps in making implicit belief systems explicit with the help of researchers' questions and analysis.
- iii) It consists of a set of steps whose careful execution is thought to "guarantee" a good theory as the outcome.
- iv) Data collection and analysis continue throughout the study.
- vi) **Phenomenology:** In this method, the behavioural phenomena is explained with the help of conscious experience of events, without using any theory, calculations or assumptions from other disciplines. The concept can be best understood with the help of one of the studies that was done in which patients were asked to describe about caring and non caring nurses in hospitals Creswell, 1998. The patients explained those nurses to be caring who show their existential presence and not mere their physical presence. The existential presence of caring nurses referred to the positive response showed by them to the patient's request. The relaxation, comfort and security that the client expresses both physically and mentally are an immediate and direct result of the client's stated and unstated needs being heard and responded to by the nurse.

Self Assessment Questions

Fill in the Blanks

- i) approach involves an active participation of the researcher in the activities of the group, culture or the community under study.
- ii) method helps in understanding and analysing the causal relationships.
- iii) helps in testing hypothesis concerning cause, effects and trends of events that may help to explain present events and anticipate future events as well
- iv) Qualitative research can be defined as
- v) The behavioural phenomena is explained with the help of conscious experience of events with the help of method
- vi) Case study is one of the widely used method in (qualitative/quantitative) research.

1.4 QUALITATIVE AND QUANTITATIVE RESEARCH: A COMPARISON

The basic conceptual difference between both of the research techniques is that, quantitative research is based on numerical or graphical representation of data whereas; qualitative research is based on observation and experiences.

Other differences:

	Qualitative Research	Quantitative Research
General Framework:	Seeks to explore phenomena using some structured methods such as in depth interviews, experiences, participant observation.	Seeks to confirm hypothesis related to phenomena using highly structured methods such as, questionnaires, surveys, structured observation.
Objectives:	It aims to describe variation, explain relationships, describe behaviour, experiences and norms of individuals and groups.	It aims to quantify variation, predict causal relationships.
Questions:	The questions used for data collection are open ended ones	The questions used for data collection are close ended ones
Representation of data:	Data is represented in form of notes, recordings and video tapes.	Data is represented in form of numbers and graphs.
Research Design:	The research design allows some flexibility in certain situational aspects. The questions used for the data collection differs individually and depends upon the response of the participants.	The research design is predetermined and stable from the beginning. The questions used for data collection are structured and same for all the participants.

(Source: Qualitative Research Method: A Data Collector's field guide)

1.5 RELEVANCE OF QUALITATIVE RESEARCH IN PSYCHOLOGY

Qualitative research methods has gained much importance in the discipline of psychology leaving other human sciences far below such as sociology and nursing, with the main motive of maintaining the historical attempt to frame psychology as a natural science.

Comparatively, natural science methods use experimental means in order to examine the causal relationships, wherein, this approach uses a large number of participants and effectively captures aspects of our human nature. Qualitative research is less interested in explaining phenomena than in understanding them and that is why it has several good relevance and implications in psychology.

Qualitative research therefore, helps in attaining an in depth knowledge of human nature, attitude, behaviour and experiences.

It has several implications in the discipline of psychology, as it:

- i) Helps in textual description of experiences of people.
- ii) Helps in identifying and explaining social norms, religion, roles of gender and socio economic status.
- iii) Helps in understanding those behavioural phenomena which can not be quantified.
- iv) Helps in collecting data under more natural situations.
- v) Helps in determining those factors which are meaningful and are important to the respondents under study.

The open ended questions used in qualitative research provide a chance to unfold those facts which can not be done with the help of 'to the point' close ended questions.

Self Assessment Questions

Choose the correct alternative

- 1) Data is represented in form of notes, recordings and video tapes in
 - a) Qualitative research
 - b) Quantitative research
 - c) Both of the above
 - d) None of the above
- 2) Qualitative research methods has gained much importance in the discipline of
 - a) Psychology
 - b) Sociology
 - c) Anthropology
 - d) All of the above
- 3) Quantitative research is based on
 - a) Field notes
 - b) Numerical data
 - c) Case study
 - d) Recordings
- 4) Qualitative research helps in collecting data under more situations
 - a) Normal
 - b) Natural
 - c) Experimental
 - d) Artificial
- 5) The questions used for data collection in qualitative research are:
 - a) Open ended ones

- b) Closed ended ones
 - c) Structured ones
 - d) None of the above
- 6) The questions of the qualitative researchers depends upon
- a) The preplanned questions
 - b) Situations
 - c) Response of the respondents
 - d) All of the above

1.6 ETHNOGRAPHY: THE MEANING

The method is also known as 'ethnomethodology' or 'methodology of people'. This type of research method basically intends to study culture through close observation and active participation. It focuses on studying socio cultural phenomena of a community. The ethnographer/ researcher collect information regarding the socio cultural phenomena from a lot of people belonging to the community under study.

On behalf of their community, the participants also identify and provide the researcher some more respondents as a representative of their community (also known as chaining process). The data is therefore collected using a chain sampling in all empirical areas of investigation. The selected samples are re- interviewed in order to elicit deeper and ambiguous responses. The ethnographer stays within the community for months in order to gain more information through chaining process and collect data in form of observational transcripts and interview recordings. The analysis of data leads to development of theories for the socio cultural phenomena under study, only on basis of the views and perspectives of its respondents.

1.7 SOME COMMON TERMS USED BY ETHNOGRAPHERS

- i) **Symbols:** Symbols refers to any tradition or material artifact of a particular culture such as art, clothing, food, technology and rituals. The ethnographer tries to understand the cultural connotations behind the symbols of a particular culture.
- ii) **Cultural patterning:** Ethnographic research believes that the meaning of symbols can not be understood until it is paired with one or more symbols. Cultural patterning refers to the study of cultural patterns formed through relationships between two or more than two symbols.
- iii) **Tacit knowledge:** It refers to those cultural beliefs which are firm in nature. They are so deeply embedded in their culture that they rarely need to be discussed by the members in an explicit way. Such knowledge can not be observed but needs to be inferred by the ethnographer e.g. the prejudices or the orthodox beliefs)
- iv) **Situational reduction:** It refers to the belief of ethnographers that social structures and social dynamism are a result of interactions of several social situations (e.g criminal acts can be due to the poor economic condition, frustration, parenthood, neighbours and peer group of the criminals)

1.8 ASSUMPTIONS IN ETHNOGRAPHY

- i) Ethnographic research assumes that the main objective of research depends upon and is affected by the interpretation of community cultural understandings. There are chances that the researcher over estimates the role of cultural perception and underestimates the role of causal reasons behind such cultural belief.
- ii) It also assumes that it is very important as well as difficult to identify the target community that requires to be studied by the researcher. Nature and size of the community as well as individuals' perception may play an important role on the subject that needs to be studied. Chances exist that the ethnographer may over estimate the role of community culture and underestimate the causal role of individual beliefs and perceptions.
- iii) Ethnography further assumes that that the researcher is an expert and is thorough with the norm and mores of the culture. The researcher is also assumed to be an expert in the language spoken in the community. Chances exist that the researcher may show biasness towards his or her culture while studying the population of another community.

1.9 TYPES OF ETHNOGRAPHIC RESEARCH

- i) **Macro ethnography:** It is the study of broadly defined cultural groupings such as – “the Indians”, “the Turkish”. The common perspectives are studied at a more larger level, which are found to be common under a more broader strata.
- ii) **Micro ethnography:** It is the study of more specific cultural groupings such as the “local government”, the “terrorists”.
- iii) **Emic perspectives:** It is the ethnographic approach under which the view points and responses of the ‘ingroup’ or the members of the culture under study are noted down.
- iv) **Etic perspective:** It is the ethnographic approach under which the view points and responses of the ‘out groups’ or the members who do not belong to the culture under study are noted down. Their viewpoints highlight the phenomena being followed under a particular culture.

1.10 PURPOSE OF ETHNOGRAPHIC RESEARCH

It helps in cross cultural analysis.

It helps in analysing the past events or the history of the culture

It helps in studying the behaviour, experiences and attitudes of individuals in a more natural environment.

Close observation increases the chances of validity in the reports and theory formulated

1.11 STEPS OF ETHNOGRAPHIC METHOD

- 1) **Selection:** The ethnographic method begins with selection of a culture. The researcher selects the culture/ community or population according to his or her interest.

- 2) **Review of Literature:** Then the researcher reviews the literature pertaining to the culture to get a brief idea and historical sketch of the culture selected for study.
- 3) **Identification of variables:** The researcher then identifies variables which interests him or her as well as the members of the culture and needs to be explored.
- 4) **Entry:** The ethnographer then tries to enter the culture and gain the acceptance of the members of the culture.
- 5) **Cultural Immersion:** Ethnographers live in the culture for months or even years which they have chosen to study. The middle stages of the ethnographic method involve gaining informants, using them to gain yet more informants in a chaining process.
- 6) **Data Collection:** After gaining the confidence of the respondents, the researcher collects information in form of observational transcripts and interview recordings and tapings.
- 7) **Development of theory:** After analysing the data, the researcher formulates theory on the basis of interpretation of the results and reports achieved.

However, the ethnographic researcher tries best to avoid theoretical preconceptions and formulates theory on the basis of the perspectives of the members of the culture and from observation. The researcher may seek validation of induced theories by going back to members of the culture for their reaction.

1.12 ETHICAL GUIDELINES IN QUALITATIVE RESEARCH

The respondents and their responses should be respected by the researcher.

The researcher must show respect and belongingness to the community he or she is studying.

The respondents must be made aware of what is being analysed by the researcher.

Researcher must ensure and maintain the confidentiality of the researcher.

Researcher should be aware of the expected risks and benefits including the psychological and social aspects while performing the research.

Self Assessment Questions

State whether True or False.

- 1) Ethnography is also known as 'methodology of culture'. ()
- 2) The ethnographer/ researcher collects information regarding the socio cultural phenomena from a lot of people belonging to the community under study. ()
- 3) Macro ethnography is the study of undefined cultural groupings ()
- 4) Out groups refers to the people belonging to the same group ()
- 5) The process of identifying and providing the researcher some more respondents by the earlier ones' as a representative of their community is also known as chaining process ()

- 6) The analysis of data leads to development of theories in ethnography.
()

State whether True or False

- i) Ethnography assumes that the researcher is an expert of the culture which he or she has selected for studying. ()
- ii) The main objective of qualitative research does not depend upon interpretation of community cultural understandings by the researcher. ()
- iii) The ethnographer tries to understand the cultural connotations using the symbols of a particular culture. ()
- iv) Cultural patterning refers to the study of cultural patterns formed through relationships between the respondents ()
- v) It is the duty of the researcher to show respect and belongingness to the community they are studying. ()
- vi) Tacit knowledge refers to those cultural beliefs which are firm in nature ()

1.13 LET US SUM UP

Qualitative research is a type of scientific research which helps in collecting, analysing and interpreting the data of a group, community, culture or a market.. It helps in understanding the reasons behind the behaviour experience and attitudes of the people of the group, community, culture or market under study. It is authentic in nature because the researcher takes an active participation in the activities of the population under study. Unlike quantitative research, it does not requires a preplanned framework, objective or interest. The primary interest of the researcher may change according to the community cultural understandings.

Out of the different techniques or types of qualitative research, 'ethnographic research' is one the most important and preferred one. Ethnography involves collection of data/ information from a number of respondents following a chain process, that is, the researcher is provided more respondents by the group of respondents who have already given their response or the required information. Data can be collected by the help of ethnography through different ways and perspectives as well.

1.14 UNIT END QUESTIONS

- 1) Define qualitative research and discuss the relevance of qualitative research in psychology.
- 2) Differentiate between qualitative and quantitative research. Do you think that qualitative research is advantageous over quantitative research? Give reasons.
- 3) Elaborate the different types of qualitative research
- 4) What do you understand by the term 'ethnography'? Describe its types and assumptions.

1.15 SUGGESTED READINGS AND REFERENCES

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Course: 5(Research Methods) Block: 4 (Qualitative Research in Psychology)

UNIT 2 GROUNDED THEORY

Structure

- 2.0 Introduction
- 2.1 Objectives
- 2.2 Goals and Perspectives of Grounded Theory
- 2.3 Methods of Grounded Theory
- 2.4 Steps of Grounded Theory
 - 2.4.1 Memoing
 - 2.4.2 Sorting in Grounded Theory
 - 2.4.3 Writing in Grounded Theory
- 2.5 Types of Coding in Grounded Theory
 - 2.5.1 Selective Coding
 - 2.5.2 Open Coding
 - 2.5.3 Axial Coding
- 2.6 Relevance of Grounded Theory
- 2.7 Implications of Grounded Theory
- 2.8 Criticism of Grounded Theory
- 2.9 Let Us Sum Up
- 2.10 Unit End Questions
- 2.11 Suggested Readings and References

2.0 INTRODUCTION

Grounded theory is one of the basic approach and most prominently used technique in qualitative research. Grounded theory refers to ‘the process of generation of theory which is based on collection of data from multiple sources’. It is the only method of qualitative research which uses quantitative data also, as and when required. The grounded theory approach aims to collect data and interpret the data from the textual base (for example, a collection of field notes or video recordings). After the process of interpreting, the data base is categorised in to different variables and then the interrelationship between these variables are analysed and studied.

Any how, the process of dividing and forming variables requires a thorough knowledge of the literature as well as the selection of the technique for creating the variables is equally important. The ability to analyse and interpret variables is termed as “theoretical sensitivity”. The theorist needs to emphasise and enhance this sensitivity. The approach of grounded theory was developed by Glaser and Strauss in 1960’s. This unit deals with the basic goals and perspectives of grounded theory. It further deals with the different methods or techniques used in grounded theory. The steps or stages used in formulation of the theory by this method will also be discussed. The unit tries to clarify the concept of the grounded theory approach and discuss the other related facts to the theoretical approach.

2.1 OBJECTIVES

After reading this unit, you will be able to:

- describe the basic approach of grounded theory;
- explain the basic goals and perspectives of grounded theory;
- analyse the different methods applied for generation of theories using the grounded theory approach;
- describe the different stages of grounded theory methodology; and
- explain the significance of grounded theory in the field of research.

2.2 GOALS AND PERSPECTIVES OF GROUNDED THEORY

Grounded theory provides a direction to the researcher and directs them to generate new theories or modify the existing ones. The interpretation and conclusion of the grounded theory approach is more reliable as it is based on data collected from multiple sources. The theory takes similar cases for analysis rather than variable perspective. The selected cases are similar on the variables, that is the variables of the cases are similar in nature but the outcome of these cases are different. The ground theorists/ researcher take these cases and compare them to analyse the causes and reasons behind the different outcomes of similar variables of the selected cases.

The *basic goals* of the grounded theory are:

- i) Since the approach consists of a series of systematic steps and the data is collected from more than one source, it assures to provide a 'good theory' as the output.
- ii) The grounded theory approach emphasises on the process by which the theory is evaluated. This determines the quality of the theory.
- iii) The grounded theory approach also emphasises on enhancing the theoretical sensitivity.
- iv) One goal of a grounded theory is to formulate hypotheses based on conceptual ideas.
- v) On the basis of the questions asked the researcher tries to discover the participants' main concern and how they continually try to resolve it.
- vi) It also aims to generate those concepts which explain people's actions regardless of time and place. The descriptive parts of a GT are there mainly to illustrate the concepts.

In the words of Glaser (1998), "GT (grounded theory) is multivariate. It happens sequentially, subsequently, simultaneously, serendipitously, and scheduled".

However, the results of grounded theories are not a reporting of facts but a set of probability statements about the relationship between concepts, or an integrated set of conceptual hypotheses developed from empirical data (Glaser 1998).

Self Assessment Questions

Fill in the Blanks.

- 1) The ability to analyse and interpret variables is termed as
- 2) The process of generation of theory which is based on collection of data from multiple sources is termed as
..... helps in formulating hypotheses based on conceptual ideas.
- 3) Grounded theories are a set of about the relationship between concepts.
- 4) Grounded theory approach is the only method of which uses quantitative data also, as and when required.
- 5) The approach of grounded theory was developed by

2.3 METHODS OF GROUNDED THEORY

Unlike other methods of qualitative research, the grounded theorists do not believe in collecting data through taping and transcribing interviews as it is believed to be a waste of time in grounded theories. The process of grounded theories is far quick and faster as the researcher delimits the data by field-noting interviews and soon after generates concepts that fit with data, are relevant and work in explaining what participants are doing to resolve their main concern.

Discussing about the theory before it is written up drains the researcher of motivational energy. Discussions and talks can either render praise or criticism, and both diminish the motivational drive to write memos that develop and refine the concepts and the theory (Glaser, 1998). Data is a fundamental property of the grounded theory which means that everything that gets in the researcher's way when studying a certain area is data. Not only interviews or observations but anything is data that helps the researcher generating concepts for the emerging theory. Field notes can come from informal interviews, lectures, seminars, expert group meetings, newspaper articles, Internet mail lists, even television shows, conversations with friends etc. It is even possible, and sometimes a good idea, for a researcher with much knowledge in the studied area to interview own self, treating that interview like any other data, coding and comparing it to other data and generating concepts from it. Interviewing one's own self helps in gaining an insight from the knowledge that the researcher has at the conceptual level and grounded theory deals with nothing but the conceptual level data.

2.4 STEPS OF GROUNDED THEORY

Grounded theory approach helps in generating theories on the basis of the following systematic steps –

2.4.1 Memoing

The first objective of the researcher is to collect data in form of memos. Memos are a form of short notes that the researcher writes and prepares. These memos act as a source of data which is further put in other processes of analysis and interpretation. These short notes or memos can be prepared in three ways:

a) *Theoretical note*

This form of note contains the details regarding how a textual data base is related to the existing literature of the concerned study. The note consists of about one to five pages. Anyhow, the final theory and report consists of an integration of several such theoretical notes.

b) *Field note*

Field note consists of the notes prepared when the researcher actively participates with the population/ culture or the community under study. It can be the observations of behaviours, interactions, events or situations that occurs on the spot and it also contains the causal notes behind such actions.

c) *Code notes*

The researcher or the ground theorist may also prepare notes by naming, labeling or categorising things, properties and events. The code notes are those notes which discuss the codes of such labeling. These code notes further acts as a source of formation of final reports. Further, these code notes also acts as a guide to the ground theorists while analysing a text or a case.

2.4.2 Sorting in Grounded Theory

Once the short notes or the memos are prepared, the collected information (or the data) is sorted in order to organise them in proper order. Sorting helps in putting all the data in proper order which leads to proper linkage of information and ideas. The researcher may also get an insight of some more relevant information and ideas which were not revealed during the preparation of memos.

2.4.3 Writing in Grounded Theory

After the memos are sorted, the next stage towards preparation of theory is “writing”. The ground theorist arranges, relates and puts the collected information in to words. Therefore, in this step the researcher tries to give a shape as well as meaning to the relevant data. This may be said to be a crucial stage, as it is this stage in which the researcher interprets the information on the basis of his own perspectives. The collected information is also linked with the existing relevant literature in order to put the theory in a scholarly context.

Self Assessment Questions

State whether the statements are true or false:

- 1) The process of grounded theories is far quick and faster as the researcher delimits the data by field-noting interviews. ()
- 2) Data is not a fundamental property of the grounded theory ()
- 3) Memos are long notes that the researcher writes and prepares during his or her survey. ()
- 4) Sorting helps in putting all the data in proper order which leads to proper linkage of information and ideas. ()
- 5) Sorting may be said to be a crucial stage in the steps of generating theories through grounded theory approach. ()
- 6) Code notes acts as a guide to the ground theorists ()

2.5 TYPES OF CODING IN GROUNDED THEORY

Ground theorists analyse and categorise events and try to identify the meaning of the text with the help of the prepared code notes. Preparation of the code notes can be done in three ways-

2.5.1 Selective Coding

In this type of coding out of all the available categories, the ground theorist selects one category to be the center or the major one and then tries to relate the other categories with the selected major category. In this way, the ground theorist tries to analyse how other categories are affecting the major category or how the major category is having an effect on the other related categories.

2.5.2 Open Coding

It is the process of identifying, labeling and analysing the phenomena found in the text. The ground theorist on the basis of generalisation categorises names, events or properties in to more general categories or dimensions.

2.5.3 Axial Coding

It is the process of relating the categories or properties (that is the codes) to each other with the help of deductive and inductive thinking. The ground theorists try to analyse the causal relations between these variables, that is, which of the code is the 'cause' which has led to the occurrence of other codes- the 'context'. The ground theorist analyses and interprets the 'cause' codes and the 'context' codes without showing much interest on the 'consequences' of the phenomenon itself.

2.6 RELEVANCE OF GROUNDED THEORY

The data or the information collected and the theory generated with the help of grounded theory is significant because –

- i) The ground theorists prepare report on the basis of information collected with the help of various sources which increases the chances of reliability and validity of the theory.
- ii) The ground theory approach gives an opportunity for exploring the facts and analysing the causal reasons behind those facts.
- iii) It is an inductive type of research which has its basis or is 'grounded' on the base of observations and data collected.
- iv) The grounded theory approach also provides a base to specify how a knowledge base should be changed in the light of new information.
- v) The grounded theory data often categorises data which further forms a basis for organising and reporting results.

2.7 IMPLICATIONS OF GROUNDED THEORY

On the basis of the significance and importance of the research based grounded theory, the discipline of research is having much gains and benefits. Following are some of the important implications of the grounded theory approach –

- i) Grounded theory is often used in formulation of policies and program evaluation research, since it can more effectively help in solving the unanswered questions,
- ii) Grounded theory approach can also be used to analyse the consumers' demands and preferences in the existing market.
- iii) The approach can also be used to analyse product positioning and advertising opportunities.
- iv) It is one of the best theoretical approaches that can be used in the field of education, management, women's studies, information studies, politics and communities, etc.
- v) It helps in understanding, analysing and describing human psychology and experience.

2.8 CRITICISM OF GROUNDED THEORY

Basically grounded theory is an approach which systematically analyses the data and generates a theory. But unlike the theory says, there exists chances that the researcher may involve some preconceptions and in collection and analysis of data. Further, there is no doubt that the collection of corpus data helps in attaining more and more information, yet the content validity is questionable in this approach.

However, the grounded theory approach is still one of the most widely used and prominent methodology in the field of social science. It has a propensity to systematically generate theories.

Self Assessment Questions

Choose the correct alternative:

- 1) In this type of coding out of all the available categories, the ground theorist selects one category to be the center or the major one—
 - a) Selecting
 - b) Axial
 - c) Open
 - d) All of the above
- 2) The process of relating the categories or properties (that is the codes) to each other with the help of deductive and inductive thinking is also known as—
 - a) Writing
 - b) Sorting
 - c) Coding
 - d) Analysing
- 3) Grounded theory is often used in formulation of—
 - a) Policies and program evaluation research
 - b) Opportunity for exploring the facts

- c) Categorising data
 - d) None of the above
- 4) The ground theorists prepare report on the basis of–
- a) The information collected
 - b) The existing information
 - c) The unexplored information
 - d) All of the above

2.9 LET US SUM UP

It can be summed up that, grounded theory is one of the best ways of systematically generating a theory on the basis of a corpus (that is a collected mass) of data. The data collected by the theorists is analysed systematically and their interpretation leads to formation of reports, which ultimately leads to creation of theories. Wherein, theory can be defined as a framework on the basis of which things, properties, behaviour and events can be interpreted. The basic purpose of the grounded theory approach is to emphasise on the process or method of formulation of a theory. Grounded theorists therefore help in providing a classic theory.

Memoring, sorting and writing are the systematic steps or stages of the grounded theory. The researcher needs to take care of the data or the information collected he or she needs to enhance the sensitivity of the variables. Grounded theory is the only qualitative research which allows the researcher to take the help of quantitative data as well. The theory has gained much importance and utilisation not only in the field of psychology, but also in management, sociology, anthropology, information, political science and several other fields. It has also gained much popularity in the field of market research.

2.10 UNIT END QUESTIONS

- 1) Describe the basic goals and perspectives of grounded theory?
- 2) Explain the steps of grounded theory?
- 3) How can you say that the grounded theory approach is one of the systematic way to generate a theory?
- 4) What are the different types of coding?
- 5) Describe the relevance and implications of the grounded theory?

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UNIT 3 DISCOURSE ANALYSIS

Structure

- 3.0 Introduction
- 3.1 Objectives
- 3.2 Definition of Discourse/Content Analysis
- 3.3 Assumptions of Discourse Analysis
- 3.4 Approaches or Theories of Discourse Analysis
- 3.5 Steps of Discourse Analysis
- 3.6 Relevance/Implications/Significance of the Discourse Analysis
- 3.7 Issues of Reliability and Validity in Discourse Analysis
- 3.8 Concept of Critical Discourse Analysis
- 3.9 Implications of Critical Discourse Analysis
- 3.10 Concept of Content Analysis
- 3.11 Examples of Content Analysis
- 3.12 Implications of Content Analysis
- 3.13 Let Us Sum Up
- 3.14 Unit End Questions
- 3.15 Suggested Readings and References

3.0 INTRODUCTION

The unit enlightens knowledge upon the basic concept of discourse analysis in the field of research. Talking about the term –‘discourse or content analysis’, in a lay man’s language, the word ‘discourse’ refers to ‘talk’, which refers to the ways in which people describe or explain their experiences. The term ‘discourse analysis’ has its origin since 1960s, and is prominently being used in interdisciplinary fields. It basically refers to the explanation of the researchers or analysts in form of talks or texts. It may be a talk or text of historical incidents or any kind of social activity like- the discourses of academic activity, the discourses of the family, domesticity or of the gang.

3.1 OBJECTIVES

With the help of this unit, you will be able to:

- explain the concept of discourse analysis;
- define discourse analysis;
- explain different assumptions, theories and approaches of discourse analysis;
- describe the steps and implications of the discourse analysis;
- explain the concept and significance of critical discourse analysis; and
- explain the concept and significance of content analysis.

3.2 DEFINITION OF DISCOURSE/CONTENT ANALYSIS

Discourse analysis has been defined in different ways. Some of the basic definitions are as follows:

In the words of Hammersley, M. (2002) It is a study of the way versions or the world, society, events and psyche are produced in the use of language and discourse. The Semiotics, deconstruction and narrative analysis are forms of discourse analysis.

Bernard Berelson defined content analysis as “a research technique for the objective, systematic, and quantitative description of manifest content of communications” (Berelson, 1974). It can also be defined as an analysis of speech units larger than the sentence and of their relationship to the contexts in which they are used.

Basically the discourse analysis identifies the linguistic dependencies which exist between sentences or utterances. Anyhow, it is really difficult to define the concept of discourse analysis. Instead of categorising it under the different kinds of research methods, it can be alleged as one of the creative ways of approaching and thinking about a problem. Alternatively, it can be said to be a way of providing a tangible answer to problems based on scientific research. Eventually the method of discourse analysis will help in unveiling the hidden motivations behind a text or behind the choice of a particular method of research to interpret that text. Expressed in today's more trendy vocabulary, Critical or Discourse Analysis is nothing more than a deconstructive reading and interpretation of a problem or text.

Self Assessment Questions

Fill in the blanks:

- i) Discourse analysis identifies the which exist between sentences or utterances.
- ii) The term ‘discourse analysis’ has its origin since
- iii) The discourse analysis may be in form of a of historical incidents or any kind of social activity like
- iv) Critical or Discourse Analysis is nothing more than a reading and interpretation of a problem or text.

3.3 ASSUMPTIONS OF DISCOURSE ANALYSIS

Theoretically discourse analysis is an interdisciplinary approach and has been widely used by the social scientists and cognitive psychologists. Some of the basic assumption of this approach can be outlined as follows:

Psychologists assume that the human behaviour can only be studied with objectivity that is, without involvement of any biasness or subjectivity of the researcher as well as the subject/people under study. However, this has been disputed – people, including researchers, cannot be objective. A researcher is

very likely to hold some position (expectation, belief, or set of cultural values) when they are conducting their research.

Those expectations may be revealed while interpreting and explaining the events and experiences.

The approach also assumes that, reality is socially constructed. It is assumed in a scientific research that ‘reality’ can be categorised. The constructs generally used by psychologists like – personality, intelligence and thinking are explained as real and naturally occurring categories or events. However, the assumption ignores the fact that it is language which gives a shape to the categories and constructs we use. Since language is a social and cultural thing, our sense of reality is socially and culturally constructed.

It is also assumed that, people are the result of social interaction. In the scientific approach it is assumed that many of the constructs used are ‘inner essences’. That is to say that personality, anxiety, drives, and so on exist somewhere within our heads and our bodies and are revealed only when the individual socially interacts with others. However, it may be the case that many of these so-called essences are actually the products of social interaction.

3.4 APPROACHES OR THEORIES OF DISCOURSE ANALYSIS

There are numerous “types” or theories of discourse analysis. The various discourses has been explained or categorised on basis of several theories and approaches. Some of them are:

Modernism: The theorists of modernism were guided by achievement and reality based orientation. Thereby they viewed discourse as being relative to talking or way of talking. They emphasised that the discourse and language transformations are needed to develop new or more “accurate” words in order to describe new inventions, innovations, understandings, or areas of interest. Both language and discourse are now conceptualised as natural or real products of common sense usage or progress. Modernism gave rise to various discourses of rights, equality, freedom, and justice

Structuralism: The structuralism theorists squabble that the human actions and social formations are related to language and discourse and they can be implicated or considered as systems of related elements. The approach believed that the individual elements of a system only have significance when they are considered in context to the structure as a whole. The structures can be defined as self-contained, self-regulated, and self-transforming entities. In other words, it is the structure itself that determines the significance, meaning and function of the individual elements of a system. Structuralism has made an eminent contribution to the world of language and social systems.

Postmodernism: Unlike the approaches of the modern theory, the postmodern theorists examined and investigated the variety of experience of individuals and groups and emphasised more on differences over similarities and common experiences. Postmodern researchers insisted more upon analysing discourses as texts, language, policies and practices. In the field of discourse analysis, the

most prominent figure was Michel Foucault. Foucault (1977, 1980) has defined discourse as “systems of thoughts composed of ideas, attitudes, courses of action, beliefs and practices that systematically construct the subjects and the worlds of which they speak.” He emphasised that the discourse analysis has a significant role in social processes of legitimating and power. Discourses can help researchers in emphasising the construction of current truths, how they are maintained and what power relations they carry with them. He later added that discourse is a channel through which power relations (for example– power relation between boss and subordinate, professor and students) produce speaking subjects and that power is an in evitable or unavoidable aspect. Foucault (1977, 1980) argued that power and knowledge are inter-related and therefore every human relationship is a struggle and negotiation of power. Discourse according to Foucault (1977, 1980, 2003) is related to power as it operates by rules of exclusion. Post-modernism was one of the mid- to late 20th century development and believes that the human mind is free from the constraints of tradition, belief, faith and tries to explore the furthest horizons of human development.

Feminism: Feminists explained discourse as events of the social practices. They investigated the complex relationships that exist among power, ideology, language and discourse. They emphasised on the concept of ‘performing gender’. According to them gender is a property, not of persons themselves but of the behaviours to which members of a society ascribe a gendering meaning.

Self Assessment Questions

Fill in the blanks

- i) The theorists of modernism were guided by
- ii) The term ‘discourse analysis’ has its origin since
- iii) The postmodern theorists examined and investigated the
- iv) Critical or Discourse Analysis is nothing more than a reading and interpretation of a problem or text.
- v) The approach also assumes that, reality is socially constructed. It is assumed in a scientific research that ‘reality’ can be

3.5 STEPS IN DISCOURSE ANALYSIS

The method of discourse analysis evaluates the patterns of speech, such as how people talk about a particular subject, what metaphors they use, how they take turns in conversation, and so on. These analysts see speech as a performance. The analysts or the researchers of the discourse analysis believe that the speech performs an action instead of describing a specific state of affairs or specific state of mind. Much of this analysis is intuitive and reflective, but it may also involve some form of counting, such as counting instances of turn-taking and their influence on the conversation and the way in which people speak to others.

The researchers collect and interpret information in the following steps:

- i) *Target orientation:* First of all, the analysts need to know their target or focus of study. Since beginning, they need to think about the ways by which they will analyse and interpret data after collecting the information.

- ii) *Significance of data:* Once the relevant information is collected, the researchers need to judge or examine the value of the collected data, especially those which may have come from more than one source.
- iii) *Interpretation of the data:* As the research progresses the analyst needs to try to understand and interpret the data so that the researchers as well as others can gain an understanding of what is going on.
- iv) *Analysis of the findings:* Finally, the researcher needs to undertake the mechanical process of analysing, interpreting and summarising the data collected. On basis of the analysis of the information, the findings can be summarised and concluded. There are many qualitative analysis programs available to social researchers that can be used for a variety of different tasks. For example, software could locate particular words or phrases; make lists of words and put them into alphabetical order; insert key words or comments; count occurrences of words or phrases or attach numeric codes. With the help of the software's, the analysts or the researcher can retrieve text, analyse text and build theories. Although a computer can undertake these mechanical processes, it cannot think about, judge or interpret qualitative data.

3.6 RELEVANCE/ IMPLICATIONS/ SIGNIFICANCE OF THE DISCOURSE ANALYSIS

With the usage of talks, languages and texts the analysts or the researchers can easily understand the connotations behind historical events as well as current social practices.

Some of the other relevance or significance of this approach are:

Discourse analysis enable us to understand the conditions behind a specific “problem” and make us realise that the essence of that “problem”

Discourse Analysis helps us in gaining a comprehensive view of the “problem” and helps ourselves to relate with that “problem”.

It helps the researcher in understanding hidden motivations within ourselves and researchers as well and therefore enable us to solve concrete problems.

Though critical thinking about and analysis of situations/texts is as ancient as mankind or philosophy itself, and no method or theory as such.

It helps in meaningful interpretation of the people and the world.

It also aids in “deconstructing” concepts, belief-systems, or generally held social values and assumptions.

Discourse Analysis can be applied to any text that is, to any problem or situation and requires no guidelines to be followed.

Self Assessment Questions

State whether the following are true or false.

- 1) Discourse analysis enables us to understand the conditions behind a specific “problem”. ()
- 2) On basis of the discourse analysis of the information, the findings can be summarised and concluded. ()

- | |
|---|
| 3) Once the relevant information is collected, the researchers need not judge or examine the value of the collected data. () |
| 4) Discourse analysis does not lead to meaningful interpretation of the people and the world. () |
| 5) Discourse Analysis can be applied to any text or problem. () |

3.7 ISSUES OF RELIABILITY AND VALIDITY IN DISCOURSE ANALYSIS

No doubt the method of discourse analysis has been well appreciated and it is being used by several disciplines, yet the approach or the methodology of this analysis lacks reliability and validity on certain grounds, like-

- i) Since the method of discourse analysis lacks a proper format or guideline, the processing of data through this approach is controversial.
- ii) Further, the interpretation of the information collected through this data is again questionable, as it may involve the subjectivity or biasness of the researcher or the analysts.
- iii) As there is no hard data provided through discourse analysis, the reliability and the validity of one's research/findings depends on the force and logic of one's arguments. Even the best constructed arguments are subject to their own deconstructive reading and counter-interpretations.
- iv) The validity of critical analysis is, therefore, dependent on the quality of the rhetoric. Despite of the above controversies and arguments, the method is well appreciated and withholds a good position and has certain concrete applications.

3.8 CONCEPT OF CRITICAL DISCOURSE ANALYSIS

The emergence of television, broadcastings and media has given a way to the out growth of the implications of discourse analysis. The method of critical discourse analysis (CDA) is nothing but one of the type of discourse based research. It is one of the method which tries to study the current social and political activities like, the way social power abuse, dominance, and inequality are enacted, reproduced, and resisted by text and are discussed in the social and political context. With the help of this research, the researcher explicitly (that is, overtly) tries to realise, experience, and ultimately overcome social inequality and injustice occurring within the society. The researcher focuses on the powerful groups of the society, especially the leaders, social groups and institutions who have a good control over one or more types of public discourse. Thus, professors control scholarly discourse, teachers educational discourse, journalists media discourse, lawyers legal discourse, and politicians policy and other public political discourse.

3.9 IMPLICATIONS OF CRITICAL DISCOURSE ANALYSIS

In order to understand, create awareness, expose and fight against the social unjust, the researcher or the critical discourse analysts takes full use of media and broadcasts. The method has the following implications for the individuals, groups, institution and society:

- i) The method allows the researcher as well as the research to be an “active agent” while attempting to expose “inequality and injustice”.
- ii) As the researcher critically tries to evaluate the social conditions, the method emphasises on both the structure and the social context of media texts .This enables the media critic to “denaturalise,” or expose the “taken-for-granted” of ideological messages as they appear in isolated speech when combined with methods of discourse analysis.
- iii) The discourse analysis is also being used critically (CDA) in applied linguistics which has led to the development of a different approach to understand the messages spread by the media.
- iv) With the help of critical discourse analysis language can be used as an interdisciplinary tool and can be used by scholars with various backgrounds, including media criticism.
- v) Undoubtedly, the method of critical discourse analysis helps in having a cross cultural study of the social activities with the help of media texts.
- vi) The method of critical discourse analysis critically tries to examine the dimensions of theoretical and descriptive accounts of texts.
- vii) CDA is one of the best forms of discourse analysis which ideologically uses language as a type of social practice.

Self Assessment Questions

State whether the following are true or false.

- i) The method of CDA allows the researcher to act as an “active agent”.
()
- ii) Language can not be used as an interdisciplinary tool. ()
- iii) The method of discourse analysis does not require proper format or guideline. ()
- iv) The method of critical discourse analysis helps in having a cross cultural study. ()

3.10 CONCEPT OF CONTENT ANALYSIS

Another form of discourse analysis is content analysis. It is one of the method which is used in summarising any form of content only after having a deep study of the actual content. This enables the researcher to more objectively evaluate and understand the situations. For example, an impressionistic summary of a TV program, can not help in analysing the over all aspects of the content of the program.

Content analysis, tries to analyse written words. The results of content analysis are numbers and percentages. It starts with the process of selecting content for analysis, then preparing the content for coding. After the content is coded, it is counted and weighed. Later, conclusions are drawn on the basis of the weighing. After doing a content analysis, the researcher can make a statement such as “27% of programs on FM Radio in November 2009 mentioned at least one aspect of antiterrorism, compared with only 3% of the programs in 2006”.

The content analysis therefore serves two basic purposes:

- i) It helps in removing much of the subjectivity from summaries
- ii) It also helps in detection of trends in an easier and simpler manner.

3.11 EXAMPLES OF CONTENT ANALYSIS

Content analysis can be done with the help of media content (when the sources of media) is being used or audience content (when individual feedbacks are being used). Few of the examples of media content are: print media, broadcasts, and recordings. While, the audience content is analysed with the help of questionnaire, interviews, group discussions and letters to the editors.

3.12 IMPLICATIONS OF CONTENT ANALYSIS

Content analysis has several implications:

- i) Content analysis enables the researcher to make links between causes (e.g. program content) and effect (e.g. audience size).
- ii) The content analysis is used to evaluate and improve the programming of the media world.
- iii) It also helps in increasing awareness and summarising the various notes or documentaries which focus on a specific issue.
- iv) It also helps in making inferences of the causes.

3.13 LET US SUM UP

It can therefore be summarised that discourse analysis is one of the techniques which uses language in form of talks and texts to analyse human behaviour and social situations. Discourse analysis and critical thinking is applicable to every situation and every subject. The new perspective provided by discourse analysis allows personal growth and a high level of creative fulfillment. The method does not require any set guidelines or framework. Rather it can help in bringing about fundamental changes in the practices of an institution, the profession, and society as a whole. However, Discourse Analysis does not provide definite answers; it is not a “hard” science, but an insight/knowledge based on content analysis and critical thinking.

Yet the method is being used as an interdisciplinary a cross cultural approach to create and experience the social and political practices.

3.14 UNIT END QUESTIONS

- i) What do you understand by the term- discourse analysis?
- ii) Explain different assumptions, theories and approaches of discourse analysis.
- iii) How can you say that the discourse analysis is a systematic process? Give your answer with respect to the steps of discourse analysis.
- iv) Explain the concept and significance of critical discourse analysis.
- v) Explain the concept and significance of content analysis.

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UNIT 4 REPORTING AND EVALUATING IN QUALITATIVE RESEARCH

Structure

- 4.0 Introduction
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4.0 INTRODUCTION

No research is complete without having detailed information of the results or achievements in form of reports of the research survey conducted by the researcher. After the collection of data, the researcher needs to analyse, evaluate and then report data in an organised and systematic way. The reports thus generated not only helps in understanding the basics behind certain events, objects, behaviours or practices; it also serves as a source for scope of future research. The present unit tries to discuss the systematic ways in which research interpretations are evaluated and reported by the researcher. It also will emphasise on the practical implications of evaluation and presentation of such reports basically in qualitative research.

4.1 OBJECTIVES

After completing this unit, you will be able to:

- define and describe the meaning of evaluating, interpreting and reporting data in qualitative research;
- explain the steps of evaluating or analysing of data in qualitative research;
- enumerate the steps in preparing report in qualitative research;
- analyse the Strategies of data interpretation in qualitative research;
- list the contents of research report; and
- explain the do's and don'ts in evaluating, interpreting and reporting data in qualitative research.

4.2 CONCEPT AND MEANING OF EVALUATING OR ANALYSING OF DATA IN QUALITATIVE RESEARCH

After collecting of data through various techniques or methods of research, the researcher tries to find out a solution to a problem, behaviour or uncertain environment. Such a solution or conclusion can be reached only with the help of systematically analysing or evaluating the data or information gathered and then organising the analysis and interpretations in form of reports. Once the data has been collected with the help of questionnaires, interviews, focus groups, or whatever, the data needs to be analysed or evaluated.

The concept of evaluation in qualitative research refers to an attempt to understand the extent to which the information collected helps in providing an answer to the pre planned aims and objectives or goals of the research. The researcher tries to evaluate the information, on basis of which he or she tries to understand the reasons, justifications or predictions of certain objects, behaviours, incidents or practices of the existing world. Evaluation helps in providing an insight to the problems or aims and goals of the research.

4.3 STEPS OF EVALUATING OR ANALYSING OF DATA IN QUALITATIVE RESEARCH

The process of evaluating the collected information or the data follows a systematic step. The researcher tries to organise and give meaning to the collected information in such a way, so that there is less chance of bias or confusion. With the help of systematically evaluating a data, the researcher can find several answers, purpose and also unveil several facts of the variables, events, behaviour or practices under study.

Following are the steps of the process of evaluating data:

- i) Reading the overall collected data
- ii) Categorising the collected data
- iii) Naming or labeling the categories
- iv) Identification of the causal relationships
- v) Recording or filing the data

Let us take up each of these steps and explain.

- i) *Reading the overall collected data:* Firstly, the researcher tries to go through the details of the information collected through various sources (for example- interviews, video tapes, audio tapes, observation and so on). This step helps in getting as much information as is required regarding the variables which the researcher selects for studying.
- ii) *Categorising the collected data:* From the collected information, the researcher or the analysts sorts relevant information, which may have a direct or indirect effect on the behaviour, objects, events or practices selected for the study. After sorting the data, the researcher categorises similar information under various categories or themes, as for example, the researcher may

categorise the information into concerns, suggestions, strengths, weaknesses, similar experiences, program inputs, recommendations, outputs, outcome indicators, and so on .

- iii) *Naming or labeling the categories:* The third systematic step in evaluation process of the research is labeling the sorted and categorised themes, for example keeping all the information of suggestions under the category of propositions.
- iv) *Identification of the causal relationships:* With the help of categorising and labeling of information, the researcher gets an idea of the direction or flow of information. This helps the researcher or the analysts to discover patterns, or associations and causal relationships amongst the categorised themes. For example, if most people of the sample under study belonged to the same geographic area, we may state that people if live in that area may have a certain problem. Or, most people of the sample under study belonged to same salary strata, then we would state that because they all have the same salary strata they are not adequately motivated. These patterns or associations of the themes are done on the basis of the experience of the responses of the sample and experience of the researcher during the study.
- v) *Recording or filing the data:* Once the patterns of relationships are analysed, the analysts need to keep a track or record of the same. These records or files serves as a guide for future reference, while the similar sample is being studied.

4.4 CONCEPT AND MEANING OF INTERPRETING OF DATA IN QUALITATIVE RESEARCH

Interpretation of data refers to summarising the findings of the data analysis in such a way that it provides useful information related to the goals of research. The researcher or the analysts attempts to put the information in the form of a viewpoint. For example, the researcher may compare the findings of the results with what was expected in the beginning stage.

It may also be a comparison or description in context of the standardised products, services or goals. Or it may simply be an explanation of the achievements and accomplishments. The interpretation may also be in a simple way of SWOT analysis (that is, analysing the strengths, weakness, opportunities and threats) of the research conducted.

While interpreting the data, it is suggested that the researchers should summarise the findings in such a way that it would not only help the group under study but also provide an opportunity for the other researchers to conduct the related research in a better and more efficient way. It is also taken care that the interpretations are summarised in such a way that the findings can be justified later on in the process of reporting. The findings should also have a proper support of the relevant literature review.

Self Assessment Questions

Choose the correct alternative.

- 1) Which of the following best differentiates evaluation from interpretation?

- a) Interpretation requires more conceptual and integrative thinking than data analysis.
 - b) Interpretation involves computerised analysis of data.
 - c) Evaluation is explanatory and interpretation conceptual
 - d) Evaluation involves conceptualisation but interpretation does not.
- 2) Which of the following describes the nature of qualitative data interpretation?
- a) Reflection
 - b) Integrative
 - c) Explanatory
 - d) None of the above

4.5 STRATEGIES OF DATA INTERPRETATION IN QUALITATIVE RESEARCH

There are various ways in which data can be interpreted or summarised. Few of them are:

- (i) Making a final list, (ii) Elaborate narratives, (iii) Use of matrices.

The researcher may summarise the labeled categories and also code them and prepare a final list of findings which can further be explained in the later stage of forming reports.

Elaborate narratives

The researcher can also give meaning or elaborate the findings from the data collected through interviews, recordings and discussion.

Use of Matrices

A matrix is a type of chart which contains words and it looks like a cross table. The researchers may use matrices if they need to compare different groups or data sets on important variables, presented in key words.

For example if the researcher wants to compare the number of girls and boys of a school who are using a cosmetic product of a company, then he may represent the information in form of the following matrix–

Table: Matrix indicating age group and gender

Age Groups	No. of boys	No. of girls
>15 yrs	45	48
>20 yrs	11	13

Figure: Matrix on introduction of a cosmetic product among students of different age groups

Flow chart

A flow chart is a diagrammatic representation of boxes containing variables and arrows indicating the relationships between these variables.

When analysing the number of boys and girls of different age groups using the product as in the above example, it can be represented in form of the following figure

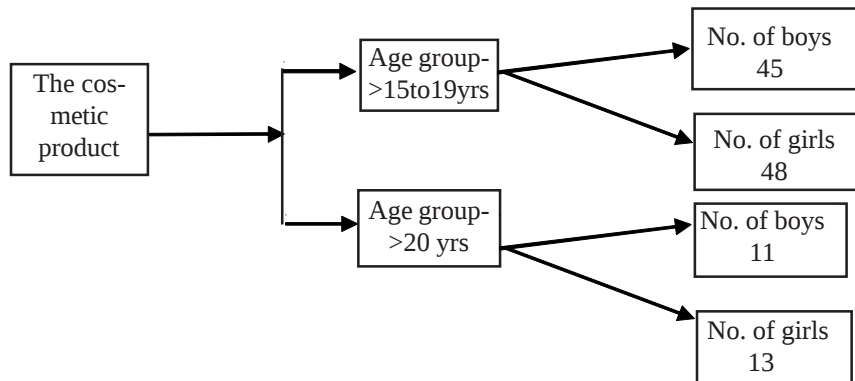


Fig.: A flow chart on introduction of a cosmetic product among students of different age groups

4.6 CONCEPT AND MEANING OF REPORTING OF THE DATA IN QUALITATIVE RESEARCH

Preparing a report of the findings of the research conducted is the ultimate challenge to the researcher or the analyst. Reporting of a data refers the ultimate discussion of the interpretations and findings backed by relevant support of relevant literature and the reasons behind such findings.

4.7 STEPS OF PREPARING A REPORT OF THE DATA IN QUALITATIVE RESEARCH

While preparing the final report of the research conducted, the researcher needs to be very cautious and least biased. The reports can be represented in an organised way, only if the following steps are followed by them, viz., (i) Preparation of the content of the report (ii) Review and discussion of the report (iii) Preparation of the executive summary (iv) Scope of future research.

i) *Preparation of the content of report*

Even before starting the procedure of writing down the report, the researcher needs to formulate the findings according to the need and requirement of those for whom the report is intended to. For example, the researcher has to create the scope and content of research on basis of the funders / bankers, employees, clients, customers, the public, etc. for whom the research was being conducted.

ii) *Review and discussion of the report*

The researcher then needs to review and also discuss the interpretations and results with the people on whom the research was conducted.

iii) *Preparation of the executive summary*

The researcher then prepares an executive summary (that is, a summing up of the conclusions and recommendations). The summary may contain the description of the organisation people, event, and practices under study. It also contains an

explanation of the research goals, methods, and analysis procedures; listing of conclusions and recommendations; and any relevant attachments. If required, the summary may also include the details of questionnaires, interview guides which have been used by the researcher.

iv) *Scope of future research*

On basis of the over all research conducted, the analyst also prepares a list of areas which may be studied further. Such scope acts as a research plan which can be referred when a similar research is conducted in the future.

Self Assessment Questions

Fill in the blanks

- 1) A flow chart is a diagrammatic representation of
- 2) Reporting of a data refers the ultimate discussion of the and findings
- 3) A matrix is a type of

4.8 CONTENTS OF RESEARCH REPORT

Since the research reports are not only a descriptive summary of the over all findings, they also act as a guide for future research in similar areas, the documentation of the report is very crucial and sensitive. The report should have a record of enough information which can be easily understood and followed as and when required. There are several ways in which the contents of a report is prepared. One of them can be discussed as follows:

1) *Title Page*

The first page of the report contains the details of the topic of the research as well as the name of the organisation that is being, or has a product/service/program that is being researched as well as the date.

2) *Table of Contents*

After getting done with the title page, the researcher prepares the list of contents of the research work and their page numbers.

3) *Executive Summary*

Then the report contains an executive summary or abstract of the research and its findings. It is usually a one-page, concise overview of findings and recommendations of the research conducted.

4) *Purpose of the Report*

The purpose of the report shows the aims and objectives of the research. It also shows the details of the type of the research (qualitative or quantitative) that was used by the researcher.

5) *Contextual background of the research target*

This topic shows a historical background of the people/ event/ practice/ program/organisation under study. It also mentions the problem that needs to be studied and also the over all goals of the research as well as the suggested outcomes of the research. The topic also shows what questions are being

answered by conducting the present research. This section may also involve the relevant literature review which was done by the researcher.

6) *Methodology*

The section of methodology deals with measures and procedures used for conducting the research. Basically it contains the following details:

- i) **Sample:** It represents the number of sample which are being used from the total population for the research study.
- ii) **Scales used:** The details of the instruments and questionnaires which are being referred for the concerned research are mentioned in this section.
- iii) **Type of data collected:** The details of the types of data (for example- interviews, questionnaires, recordings, observations etc.) are also mentioned in the methodology section.

7) *Results and findings*

This section deals with the analysis of the data collected. It discusses the results and findings of the research.

8) *Interpretation and Conclusion*

This section deals with the interpretation and discussion of the findings of the data analysed. On basis of the interpretations, the results are concluded. The conclusion section shows how the result is significant and to what extent is it helpful to the research targets and other researchers.

9) *Limitations of the study or research*

This section consists of the restrictions of limitations of the findings. It shows how and under which conditions the results can be generalised.

10) *Recommendations and implications*

The researcher recommends suggestions and implications of the study conducted.

11) *References*

The researcher acknowledges the authors, books, studies and journals which were helpful in providing relevant literature review for the research conducted.

12) *Appendices*

The last section of the research report contains the various sources (like questionnaire, company forms, case studies, data in tabular format, testimonials) which were analysed and used by the researcher.

4.9 DO'S AND DON'TS IN EVALUATING, INTERPRETING AND REPORTING DATA IN QUALITATIVE RESEARCH

While evaluating, analysing and reporting the data, the analyst needs to be cautious regarding the following do's and don'ts –

Do's:

The researcher should take full care and always try to include the following aspects while processing the data.

- 1) The analyst should be clear, specific and describe the sample populations
- 2) The analyst should code the data for their convenience in processing the data.
- 3) The analyst should frequently use diagrams, flow charts or matrices for conveniently summarising and explaining the data.
- 4) The analyst should draw conclusion on basis of the present study and other related study in the similar field.
- 5) As and when required, the analyst should develop policies for further evaluating or confirming the (qualitative) data in order to prove their validity.

Don'ts

The researcher should take full care and always try to exclude or avoid the following aspects while processing the data:

- 1) The analyst should not depend fully upon the research design selected as no research design is perfect on its own.
- 2) The analyst should not interview about only the successes, the failures can also provide significant information to them.
- 3) The analyst should not completely depend upon questionnaires, as much of the information can only be available through observations and interviews.

Self Assessment Questions

State whether the following statements are true or false—

- 1) The analyst should be clear, specific and describe the sample populations. ()
- 2) The analyst should interview about only the successes. ()
- 3) Results are concluded on basis of interpretations. ()
- 4) The analyst should avoid the frequent use of diagrams, flow charts or matrices. ()

4.10 LET US SUM UP

On basis of the above discussions, it can be summed up that the quality assessment of qualitative research studies still remains a challenging area. The systematic steps of each procedure in the way of processing the data (that is, evaluating, interpreting and reporting) is equally significant and case sensitive.

The reliability of the report depends upon the selection of good strategies while interpreting the data. The researcher also needs to be cautious with certain do's and certain don't's (pitfalls) while processing the data of the research conducted.

4.11 UNIT END QUESTIONS

- 1) Describe the concept and meaning of evaluating, interpreting and reporting the data in qualitative research?
- 2) Explain the steps of evaluating or analysing of data as well as preparing report in qualitative research?
- 3) Illustrate the strategies of data interpretation in qualitative research?
- 4) What are the basic requirements that are needed to be included as well as avoided while processing the data ?

4.12 SUGGESTED READINGS AND REFERENCES

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